POPULAR SCIENCE

FOUNDED MONTHLY 1872

APRIL

25 CENTS

30 CENTS IN CANADA

EACH WHEEL
A STEAM ENGINE!

See Page 63

$10,000 *in* Cash Prizes

SEE PAGE 22

20 years of HARD LABOR!

It was 1912 when two SKF Bearings dipped their pens in the ink of Performance and started to prepare this advertisement. It is not finished yet. You see, the bearings aren't...and 20 years have gone by.

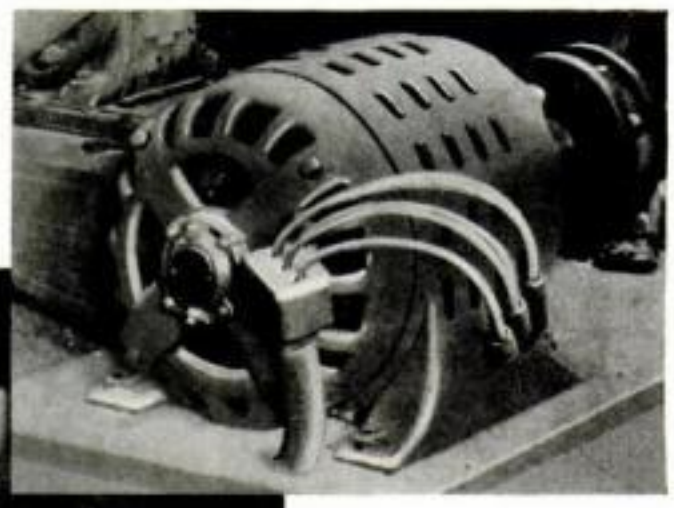
For in 1912 these two SKF Bearings went into a Fairbanks Morse motor that in turn went into a St. Louis woodworking plant the very same year. The same old motor is still doing duty today on the same old pair of SKF Bearings.

Perhaps ten years from now this pair of SKF Bearings, still functioning in the same Fairbanks Morse motor, will write another advertisement for SKF . . . SKF Industries, Inc. 40 East 34th Street, New York, N. Y.

● **Two SKF Bearings Began Writing This Advertisement in 1912**

SKF

BALL AND ROLLER BEARINGS



One of 50 SKF equipped Fairbanks Morse Electric Motors installed in a St. Louis woodworking plant in 1912.

A PROMISE IS ONLY A PROMISE...
***PERFORMANCE* IS HISTORY**

2833

Value · proved by PERFORMANCE

PERFORMANCE is a yard-stick by which the value of any refrigerator can be measured.

In more than a million homes, the General Electric *All*-Steel Refrigerator has established a record for attention-free, continuous service without parallel in the history of refrigeration. Years from now, your General Electric's unfailing operation will continue to provide economy, convenience and positive health-protection.

A General Electric requires no attention, not even oiling. Simple, current-saving mechanism, hermetically sealed-in-steel in the famous Monitor Top, is out of reach of dust and moisture. The cabinet itself is built entirely of steel—to assure long life, free from service.

INVEST IN AN ELECTRIC REFRIGERATOR

General Electric's sliding shelves afford more readily usable storage space. The super-freezer is all-porcelain, easy to clean and has adequate ice capacity. Interior is of acid and stain-resisting porcelain. And every General Electric is guaranteed for three years against all service expense.

* * *

Write for a copy of our magazine "The Silent Hostess," it will be sent to you free. Each issue contains delightful recipes, household hints, health talks, entertainment ideas by noted authorities. Address, General Electric Co., Electric Refrigeration Department, Section M4, Hanna Building, 1400 Euclid Avenue, Cleveland, Ohio.

Join the G-E Circle. A special program for women every day at noon (except Saturday). On Sunday at 5:30 P. M. a program for the whole family. (Eastern Standard Time). N. B. C. coast to coast network

GENERAL ELECTRIC

ALL-STEEL REFRIGERATORS

DOMESTIC, APARTMENT HOUSE AND COMMERCIAL REFRIGERATORS, ELECTRIC WATER COOLERS

25 Cents a Copy
$2.50 a Year

POPULAR SCIENCE MONTHLY

381 Fourth Avenue
New York, N. Y.

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April, 1932, Vol. 120, No. 4. **Popular Science Monthly** is published monthly at 381 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Single copy, 25 cents (30 cents in Canada). Nine months subscription in U. S., $2. Yearly subscriptions to United States and its possessions, $2.50; foreign countries, including Canada, $3. A. L. Cole, President and Treasurer; R. C. Wilson, Vice President; John Nichols, Vice-President; F. W. Briggs, Secretary.

Popular Science Monthly for April, 1932

NEW DEVICES FOR THE HOME

NEW PROCESSES AND INVENTIONS

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UNUSUAL FACTS AND IDEAS

FOR THE HOME OWNER

CRAFTWORK

WOODWORKING

IDEAS FOR THE HANDY MAN

HINTS FOR THE MECHANIC

HOW TO Quit Work at Sixty *and still draw good pay*

By LEON MEADOW, *Financial Editor*

"SAY, Peter, have you heard anything recently about old Mr. Farwell?" Martha Nixon asked her husband one evening at the dinner table.

"You mean that old chap, with all the money, who lives over on Oak Street? No, I haven't heard anything about him. Why, what's up?"

"Well it's a terribly unfortunate case, if you ask me," replied his wife. "One of the girls at the bridge party this afternoon—I think she knows his daughter-in-law—was telling us that the poor man hasn't a cent to his name—or very little, anyway."

"Not a cent to his name!" Peter exclaimed. "Why, old Farwell is known in this town as Mr. Wall Street. He's supposed to have more stocks tucked away in his vault than any one else in town."

"If you'd let me finish what I was saying, Peter, instead of interrupting. . . ."

"Sorry, dear—but to hear that about him, of all men."

"Well, it seems," his wife continued, "that he might as well forget all about his stocks, for all the good they'll do him now. I understand from this girl that they're practically valueless—and most of them have stopped paying any dividends at all. . . . And what's more she told me that the business he's interested in has been terribly hit the last two years, and that he hasn't been able to draw bare living expenses out of it."

"That's a shame," Peter muttered . . . "but, Martha, can't we talk about something pleasant?"

* * * * * * * * *

PETER NIXON couldn't dismiss it that easily. Walking down to his office the next morning, he found himself thinking about his own situation. Farwell must be about sixty-five, Peter reflected. How would he be fixed at that age? He had no assurance that he'd be able to continue working—and where was he going to get an income to live on?

That day at lunch, Peter told Larry Fox, an old friend of his, what was on his mind. When he was through Larry laughed and said, "Well, if that isn't the strangest thing."

"I don't see anything to laugh about," Peter said angrily, "and why should it be so strange? How many men at 28 have laid any definite plans for the future? How many can look forward to retirement at 60 or 65?"

"You've got me wrong, Peter," Fox replied. "I was simply laughing at the coincidence of your bringing up the very question that had bothered me for a long time, and which I think I have finally solved this morning—that is, to the best of my ability."

"How, what, when and where?" asked Nixon. "If I'm not intruding."

"Not at all. I bought $165 a month income for myself, starting when I'm sixty—for the rest of my life."

"Too bad we're not all millionaires," Peter exclaimed.

"Who the devil is talking about millionaires," Larry answered. "I'm no better off than you are—I don't have to tell you that. The only reason I'm offering to tell you this is because I think my experience may be of some value to you. Now, shall I— or shall I not?"

"You shall, Larry—and with a very grateful listener."

"THEN, to proceed—this morning I invested in my ability to save money over a long period of years, and my money is going into an organization that holds its own through all times, bad and good. An organization that absolutely guarantees the return of my money with unusually attractive additions. Now, let's get down to business. I'm 26—and for the next 34 years, till I'm 60, I am going to deposit $377.40 a year, which is a little over $7 a week. Roughly speaking, I shall have deposited altogether $12,830."

"Wait a minute, Larry," Peter interrupted, "is this insurance?"

"And what if it is?" his friend answered. "As a matter of fact, I wasn't going to spring the news until after I'd finished describing the *investment* features of this program to you. So many men still think of insurance as a purely 'dying' proposition, that they become prejudiced the minute they hear the word 'insurance'. The plan I'm talking about has so many fine investment possibilities, that it's hardly fair to call it insurance. But since you've guessed, we needn't disguise it."

"I have nothing against insurance," Peter said. "I think it's the greatest thing there is—and the plan you're describing is beginning to appeal to me already."

"Let's continue, then. At sixty, I have deposited $12,830. After that, I can do any one of five things. I can draw $10,298 in cash; accumulated dividends—and *in addition* $100 a month for the rest of my life."

"No matter how long you live?" Peter interrupted.

"That's right," Larry replied. "By the way, Peter, the chap who lined me up on this investment program told me that insurance men have a saying that 'annuities'—that is, people who insure themselves for old-age incomes—'never die!' I hope he's right—for about *(Continued on page 5)*

HOW TO QUIT WORK AT SIXTY—AND STILL DRAW GOOD PAY

(Continued from page 4)

20 or 25 years, anyway. After that, I think I will have had enough."

"Sounds like a great plan, Larry. If you live to be 85, you will have drawn almost $50,000—on an original investment of $12,000."

"Right again," Fox answered. "But that's not all. I mean there are other options which I can exercise when I'm sixty. It may happen that I should need a lot of cash at that age, for some reason or other. In that case—I can withdraw my entire investment."

"How much would that be—about $15,000?"

"You're conservative, Larry. As I remember the figures, it would be a bit over $26,000—which would guarantee me a monthly income of $165 for the rest of my life, or, if I prefer, a slightly smaller income for my wife and myself as long as either or both of us live."

"$26,000! How can it be so much? That's more than double your total deposits!"

"SURE it is—but you forget, or don't know, that the annual deposit I make of $377 is a *gross* premium—that is, leaving the dividends with the company. And it also takes into account this factor: that after I pay these premiums for 22 years—till the time I'm 48—the plan is completed, and I can receive, if I wish, a fully paid-up $10,000 insurance policy participating in dividends—and then, when I'm 60, start to receive $100 a month for the rest of my life. On the other hand, if I continue, as I intend, to pay these premiums after the 22nd year and up to the time I'm sixty, the total cash value then mounts up to $26,000, as I just told you.

"It's this way, Larry. When I'm 60, the total cash value on my $12,000 investment has grown to almost $16,000. By leaving my annual dividends with the company for reinvestment, they actually reach a total of more than $10,000—or altogether, about $26,000. Now, there are still two more ways I can juggle this total around, when I'm sixty. One is to draw out a total of about $19,000 and still have $10,000 worth of paid-up insurance, participating in dividends. Or, finally, I can draw out about $10,000 and still have something like $23,000 in paid-up, dividend participating insurance."

"Well, Larry, that certainly sounds like a lot to me. I don't know much about insurance, and this is really the first opportunity I've had for learning about it on an income investment basis."

"I know how you feel, Peter. I was in much the same position until this morning, when the plan was put before me from a strictly investment angle. And I can see that you've had your eyes opened, just as I did."

"I suppose, in a program like this," Peter asked, "there isn't much of a death benefit or protection for beneficiary, is there?"

"I wouldn't say *(Continued on page 6)*

SMOKER PENS CONFESSION

Is Devoted to One Tobacco

Pleads with Makers To "Keep Up Good Work"

Loyalty is a common attribute of pipe smokers. But the loyalty of Mr. N. Sadlier-Brown, a resident of British Columbia, is of a kind and degree that would make any manufacturer feel proud of his product. Here is Mr. Sadlier-Brown's letter:

Blue River
British Columbia
November 26, 1931

Larus & Bro. Co.
Richmond, Va., U. S. A.

Dear Sirs:

It seems to me that I have been overlooking an obligation in not writing to you what I think about your valuable product, Edgeworth Smoking Tobacco. If a good thing is made, it should be boosted by its users.

Edgeworth is the coolest tobacco I ever smoked, and I've tried plenty. It has a flavor all its own, and the "flavor lasts" to the very bottom of the pipe. It's a high grade tobacco, and other tobaccos priced the same don't touch it for quality.

Most important of all, it's the only tobacco I can smoke. I have a bronchial throat, and every make of tobacco I ever tried irritates it—except Edgeworth.

So keep up the good work, for if you stop making Edgeworth I shall have to stop smoking.

Yours faithfully,
N. Sadlier-Brown

The makers of Edgeworth assure Mr. Sadlier-Brown that they certainly *will* "keep up the good work." And they want to assure him too that he will find the same fine quality in the Edgeworth he buys *anywhere*.

Perhaps you have never smoked a pipe. Perhaps you tried a pipe and found it wanting. In either case you are missing some of the real joys of smoking until you know the solid satisfaction of a good pipe *with Edgeworth Smoking Tobacco*. Edgeworth is a blend of fine old burleys with its natural savor insured by a distinctive and exclusive eleventh process.

Your name and address, sent to Larus & Brother Co. at 110 S. 22d St., Richmond, Va., will bring you a free sample packet of Edgeworth. Or you can buy it in two forms—Edgeworth Ready-Rubbed and Edgeworth Plug Slice. All sizes from the 15-cent pocket package to the pound humidor tin. Some sizes come in vacuum tins.

Do you enjoy listening to the singing of spirituals? Every Thursday evening a group of Edgeworth workers gather at the Edgeworth factory to sing spirituals. You can hear them over the N. B. C. Blue Network.

HOW TO QUIT WORK AT SIXTY—AND STILL DRAW GOOD PAY

(Continued from page 5)

that," Larry replied. "Up to the time I'm 52, or so, this program covers me for about $10,000 worth of straight life insurance. Of course, after that, my actual deposits start to grow larger than the cash value of this coverage, so the latter also increases, till it reaches about $15,000 when I'm 60—although, by then, I have only paid in $12,000.

"Not only that, but should I go, before I'm 60, the returns to my beneficiary are payable in the form of monthly income payments of not less than $100 for 10 years certain. Incidentally, this '10 year certain' clause holds good after 60 as well as before—within, of course, the limitation of the cash value of the investment. That is to say, if I should die at 65, after drawing a monthly income for five years, my beneficiary would continue to draw that same income for another five years."

"NOW that I know that much, I know that this is the investment for me," said Peter. "But $7.00 a week is sort of steep right now."

"As far as I know, there's no reason why you can't start at any figure you think is within your means. The plan is worked out in a unit basis of $1,040 worth of insurance—and $10 a month income for life, beginning at age 60. Proportionately speaking, the returns for whatever annual deposit you make are the same. Aside from everything I've said, the beauty of this plan is in its cash or loan value—and you never know when that feature may come in mighty handy. Ten years from now, I'll have a cash or loan value of about $3,000 in this investment. Thirty years from now it will be more than $12,000.

"I wouldn't say that this is the strongest feature of this plan, for it's far from it. The best part of it lies undoubtedly in the fact that the plan is safe—and that after you have succeeded in saving money for the specific purpose of guaranteeing yourself financial independence, you can be assured that your money is safe. Not only that, but also, because the plan of investment is constant, it frees you from the necessity of making frequent decisions and worrying whether or not you've made the right ones.

"Then again, it takes the problems of investment off your mind by turning them over to men qualified to meet and overcome the obstacles ordinarily confronting men like you and me when we do have to find a place for what little money we have.

"These, together with the tremendous attractiveness of the retirement income feature," continued Larry, "are of course the principal 'high-spots' of this investment program. But you can't overlook that cash or loan value, as so many men, who carry insurance, do. Even if you should never have need to call upon the reserve, it's certainly comforting to know that you always have some money behind you—rather than (Continued on page 7)

A definite program for getting ahead financially will be found on page four of this issue

HOW TO QUIT WORK AT SIXTY—AND STILL DRAW GOOD PAY

(Continued from page 6)

wrongly thinking that a plan of this type is just a drain on your resources, and only begins to mean something after what seems like an unbelievably long time."

"I check with you there, Larry," Nixon said. "I think you've given me the answer to my problem, and I've been worrying about it a lot since Martha mentioned old man Farwell to me last night. I think you have an ideal set-up in this investment and retirement income plan of yours, and what's more, I think it's too bad you're not an insurance man."

"Why so, Peter?"

"Because if you were," his friend replied as they left the restaurant, "you would have made a sale today!"

To Help You Get Ahead

THE booklets listed below will help every family in laying out a financial plan. They will be sent on request.

The Investment Aspect of Life Insurance, by M. A. Linton, presents life insurance as an exceedingly worthwhile investment as well as a form of protection. Provident Mutual Life Insurance Company of Philadelphia, Pennsylvania, will mail a complimentary copy upon request.

Before 65 and After explains the full details of a Retirement Income, with full Life Insurance, Disability and Double Accident benefits. Sent on request by The Equitable Life Assurance Society, 393 Seventh Avenue, New York City.

How to Get the Things You Want tells how you can use insurance as an active part of your program for getting ahead financially. Phoenix Mutual Life Insurance Company, 328 Elm Street, Hartford, Conn., will send you this booklet on request.

Enjoy Money shows how the regular investment of comparatively small sums under the Investors Syndicate Plan, with annual compounding of 5½% interest, builds a permanent income producing estate, a financial reserve for a business, or a fund for university education or foreign travel. Write for this booklet to Investors Syndicate, Investors Syndicate Building, Minneapolis, Minnesota.

See How Easy It Is tells how it is possible to start off with a definite plan for creating an immediate estate leading to future financial security. Get your copy of this booklet by writing to Postal Life Insurance Company, 511 Fifth Avenue, New York City.

Booklets, Samples, Information, Available To Popular Science Readers

By referring to the advertisements on the pages indicated below, you can solve a great many problems. Most of the advertisers in Popular Science Monthly offer valuable catalogues of tools, or booklets of information and instruction. Others will send you samples of products ranging all the way from shaving cream, to glue, and tobacco. We recommend these advertisers to you. There is so much real information in their announcements in this magazine that readers of Popular Science Monthly will find them not only interesting but decidedly helpful as an index of the most modern and practical devices and developments.

Popular Science GUARANTEE

POPULAR SCIENCE MONTHLY guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in POPULAR SCIENCE MONTHLY may expect them to give absolute satisfaction under normal and proper use.

Tools, Radio Apparatus, and Oil Burners advertised in POPULAR SCIENCE MONTHLY have been tested or investigated by the Popular Science Institute of Standards and each advertisement carries the insignia indicating approval.

However, other products advertised in the magazine not subject to test carry the same guarantee to readers as products tested.

THE PUBLISHERS

Insulate your Garage with INSULITE

Protects against COLD WEATHER . . is easily handled - quickly applied

IT'S a grand and glorious feeling to walk out to your garage on a cold winter morning . . . get in your car . . . step on the starter and hear the motor begin to purr. This pleasure can be yours if your garage is lined with Insulite.

This highly efficient, strong and durable Insulite board shuts out the frigid blasts of winter and, furthermore, the large rigid panels add structural strength to the building . . . are easy to handle and apply.

FREE GARAGE PLANS . . . It's easy to insulate your garage or build a new one with Insulite. Anyone handy with a saw and hammer can do the job. May we send you samples and a copy of our free booklet, "How to Solve Your Garage Problem?" It contains complete plans for building both one and two car garages. Your lumber dealer can supply you with Insulite.

GOING TO BUILD OR REMODEL?

Let us send you a free copy of our booklet, "Increasing Home Enjoyment". It gives the facts about Insulite and is chuck-full of clever ideas for transforming waste space in attic or basement into useful and attractive rooms.

This free booklet contains complete plans for building both a one and two car garage . . . SEND FOR IT.

THE INSULITE CO.
1200 Builders Exchange, Dept. 43D
Minneapolis, Minnesota
OFFICES IN ALL PRINCIPAL CITIES

These products, developed and manufactured by The Insulite Co., fill every insulation requirement in the building field . . . Insulite Building Board, Super Lath, Standard Lath, Fire-Proofed Board, Termite Board, Wall Board, Fire-Proofed Wall Board, Roof Insulation, Acoustile, Hard Board.

INSULITE

THE WOOD-FIBER INSULATING BOARD

Make Your House Livable with INSULATION

By R. M. Bolen

Secretary, Popular Science Institute

IF YOU could build a perfectly heat-proof house like a giant thermos bottle, you could heat it through a hard winter for little more than a few cents a day. And in the summer, the rooms in your house would be as cool as a shaded dell in the woods.

Unfortunately, it is not practical to construct buildings along thermos-bottle lines. It is possible, however, to go part way towards obtaining this ideal house by applying inexpensive insulation material at the points in your home where it will do most good. Insulation properly applied will not only greatly reduce the cost of heating, but will allow perfect heat control twenty-four hours a day and three hundred and sixty-five days in the year.

To prove to yourself what an approved insulating material will do, all you need is a large cooking vessel, a thermometer, a small glass beaker, a piece of insulation board and one of wood of the same size and thickness, and a piece of sheet metal slightly larger than the wood.

A TEST FOR INSULATION. A large cooking vessel, a small glass beaker, a thermometer, pieces of wood and insulation board of identical size, and a larger piece of sheet metal is all that is needed to show the value of insulation

Place the large vessel, about half filled with water, on a gas burner and allow the water to come to a boil. Then place the sheet metal over the top. The wood and the glass beaker partially filled with water whose quantity and temperature is known is then placed on top of the metal. With the improvised apparatus placed as shown in the photograph on this page, allow the water in the large vessel to boil for a known length of time and then note the rise in temperature of the water in the beaker.

THIS is repeated, using insulation board instead of wood. If the test is carefully made and the starting conditions are the same, you will find that the temperature rise in the water becomes much greater when insulated by the wood. In other words, more heat can leak through the wood in a definite length of time than through the same thickness of insulation board. This demonstrates how insulating material acts in your home. In winter, heat is retained within the walls and ceilings; in summer, outside heat is unable to leak in.

The cost of insulation board is a small item compared with the savings in fuel which it effects annually. Let us take, for example, a case that has just come to the attention of the Popular Science Institute. L. K. B. writes that he built a house which cost him approximately $10,000. One-half-inch insulation board was used in the walls and one-inch board in the second floor ceiling. This additional item cost L. K. B. $103; but, through its use, the builder was able to save $43 in materials and labor. This brought the extra investment down to $60. L. K. B. states that in the first year he lived in the house, he spent $25 less for fuel than had been originally calculated on the basis of uninsulated walls and ceilings. This saving is netting him an average annual return of almost forty-two percent on his original investment of $60.

Aside from its use as a material in the building of a new house, insulation board can be easily applied on houses that are already built. Its use in attics makes it a simple problem to build additional rooms and utilize space that would otherwise go to waste.

BOOKLET ON INSULATION

For those readers who wish to go into the matter of house insulation more thoroughly, a booklet has been prepared which describes in detail the various materials, their relative effectiveness, method of applying, etc. A large amount of helpful information will be found in this twenty-four-page booklet, entitled, "Insulation in Building Construction." To obtain it, send 25 cents to Popular Science Institute, 381 Fourth Avenue, New York.

HIS CHECK BOOK

revealed the disgraceful truth!

Too many fuel dollars spent—too many days of comfort lost — because he didn't ask his architect about Armstrong's Temlok Insulation

TOO much money spent for fuel! How often a check book reveals this waste—even today, when people should know that insulation is an accepted building need.

In the home you build, it is important to tell your architect, "Insulate with Armstrong's Temlok." You add on the average not more than 1% to total building costs. But you are repaid quickly in fuel saved. And then you get annual dividends in lower fuel bills, and in comfort.

Temlok also can help you economize in the house already built. Suppose you line the attic with this efficient insulation. Immediately you save fuel, since heat is prevented from leaking through the roof. A few $10 bills pay for the job, and for the extra comfort you get.

Armstrong's Temlok is lifetime insulation. Furnace heat doesn't escape from the Temlok-lined house or room in winter, nor does sun heat cause discomfort in summer. The qualities of Temlok also make it ideal comfort-lining for summer cottages, garages, and farm buildings. Clip the convenient coupon. It will bring you a sample and a booklet.

Armstrong's (A) Product

HAVE YOU TALKED TO AN ARCHITECT? *It costs nothing. Yet it may save you a lot of money. There is no obligation. Whether you are building or remodeling a large house or small, he will be interested. Let him show how he can save you money—and still build you a better home. If you don't know the worthwhile architects in your community, ask your builder or lumber dealer.*

Temlok also is used for the insulation of domestic refrigerators because this efficient material resists the passage of heat, and thus helps to keep food fresh economically.

BUILDING OR REMODELING. *Armstrong's Temlok provides the ideal insulation for your home. In this cozy chess-room, Temlok is applied to walls and ceiling as a natural finish. Its rich, warm buff texture says "welcome" to host and guests.*

Armstrong's
TEMLOK
BUILDING INSULATION

Armstrong Cork & Insulation Co.
967 Concord Street, Lancaster, Pa.

Please send me free sample of Armstrong's Temlok and booklet, "New Home Comfort at Lower Cost," giving complete details.

Name_____

Street_____

City_____ State_____

MADE BY THE MAKERS OF ARMSTRONG'S LINOLEUM AND ARMSTRONG'S CORKBOARD INSULATION

Our Readers Say

Einstein Gets Knock-out Punch from Quiet Ohio

If Popular Science Monthly is not as hopelessly hog-tied with Professor Einstein's theories as are several other magazines, its columns may be available for the publication of a three-dimensional interpretation of the "red shift" observed in the spectra of the more distant nebulae.

Those who are familiar with spectrum analysis will readily perceive that the prevalence of this "red shift" indicates a cosmic expansion, and if they are familiar with the modern adaptation of the Newtonian hypothesis, they may also perceive that Einstein's improvisation of a fifth dimension to account for this expansion is wholly superfluous. Observations indicate that there is a definite acceleration in the recession of these remote masses, and this acceleration indicates a gravitational actuation. Assuming that gravity is the effect of the pressure of the ether, a diminution of that pressure in ultra-cosmic space would account for the acceleration and relegate Einstein's conceptions to the realm of psychopathy.—E.H.P., Wellington, Ohio.

Science Makes No Effort to Discredit the Bible

Just a word to H.A.E., whose letter appeared in a recent issue of Popular Science Monthly: Scientists aren't persuading people to discredit the Bible. They are merely giving a scientific viewpoint of their understanding of life and its origin. As the late Thomas Edison once said: "How can a man, accustomed to dealing with practical things, believe in something he can neither smell, see, hear, feel, nor touch?" Many times, because of economy, I've wanted to stop buying your magazine, but articles like those by Dr. Gregory and Mr. Mok and Mr. Teale have held me.—J.S., Brooklyn, N. Y.

Why Not Drop It When Everything's Told?

I very much enjoy your magazine, especially the historical aviation articles. However, you seem to me to create a lot of interest and enthusiasm about a subject and then completely drop it. I think you should follow up your articles.—R.A.E., Annapolis, Md.

Praises Wailes's Chemistry and Wails for More

Those articles on chemistry by Raymond B. Wailes are great. I have built a little laboratory down in my cellar, but I was puzzled by the problem of drainage. I made my own test tube rack and put up shelves similar to those described in Popular Science Monthly. Print more of these chemistry articles. I have taken your magazine for two years and have read every copy carefully. It is a swell magazine—except for Professor Gregory's articles, which are bunk.—B.S.L., East Milton, Mass.

Perpetual Motion, Come Out and Prove You're Right

"Our Readers Say" department is the spice of Popular Science Monthly. Without that the magazine, although the best one of its kind I've ever seen on the market, would be like a big plate of spaghetti minus cheese and sauce. With a few exceptions those letters from your readers are mighty interesting. I was most interested in the letter from R.R.B. of Durham, Calif., who claims to have solved the age-old problem of perpetual motion power. I'm confident R.R.B. merely *thinks* he has pulled that trick. At any rate, the fact that he claims to have constructed a machine that runs of its own accord is interesting in itself, if true, and I would suggest that you investigate the thing a little. I'm pretty sure R.R.B. has done nothing of the kind, as far as real perpetual motion is concerned. Your detective articles are wonderful. Keep up the good work. At last we've got our long-sought-for *chemical department*. I sure am glad to see it.—A.V., New York.

For 7 Years, He's Glad to State, We've Kept His Radio Up-to-Date

I wish to compliment you on your excellent magazine. I have been a regular reader for years and go through the magazine from cover to cover. It is all very interesting and instructive, and I find myself looking forward to the coming of the next issue. Back in 1925, I assembled a four-tube radio set which I have kept up-to-date by following the articles in that department of Popular Science Monthly. In fact, I have learned much about this marvel of our day through the medium of your magazine.—D.E.B., Cleveland, Ohio.

No Fiction for Him in This Magazine

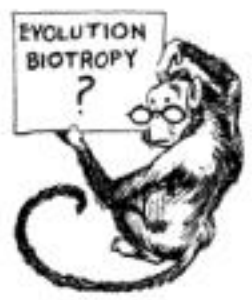
In answer to C.B.S., Independence, Kans., I want to say that I like to read fiction as he describes it in his letter and I believe there are many readers who would enjoy such stories, but why spoil, with such bunk, a perfectly good magazine that gives up-to-date facts about science? Let me give three cheers for your department on chemistry.—L.S., Philadelphia, Pa.

This Radio Ham Wants Big Department

My hobby is amateur radio, so you can probably guess what's coming. Why not have a larger section devoted to radio in general, and some good dope on amateur radio in particular? There are over 22,000 licensed amateurs in this country who can't find enough to read concerning this great hobby, besides the thousands of other radio fans who haven't got the transmitting bug yet. Why not run some good constructional articles on amateur receivers, transmitters, and other allied equipment, including that all-important instrument (in these days of strict enforcement of amateur regulation), the frequency meter or monitor. Also, it should be possible to get plenty of meaty dope about the activities of American and foreign amateurs.—D.L., Poughkeepsie, N. Y.

Biotropy for Evolution Gains a Supporter

In a recent issue of Popular Science Monthly, under the heading "Our Readers Say," I note at the bottom of column two, a "New word to take the place of evolution." This is signed by H. W. C. If his suggestion is original, he should be given full credit by name, and further, contribute a short article to some scientific magazine stating his reasons in detail for this substitution. If he has obtained the idea from other sources, he should give credit to the original. The change by substitution of the word "Biotropy" for "evolution" may be beneficial, in view of the popular mass conception of the latter term. Such a synonym is amply borne out in all of the sciences, either because of difficult pronunciation, lengthy terms, or popular mass construction placed upon such scientific terms. If it is not too much trouble, kindly call this to the attention of the author of this article.—C.S.M., Philadelphia, Pa.



That Twenty-five-mile Visible Airplane Is 420 Feet Up

I wish to give the answer to the problem of M.O. of San Francisco, Calif., regarding the height necessary for an airplane in order to be seen twenty-five miles away. The height of the plane in feet is approximately equal to two-thirds times the square of the distance of the horizon in miles. The correct answer is 420 feet within the limits of accuracy, if the measurements are both taken at the same level. We're glad to see the articles on chemistry. How about a motorcycle page?—P.W., West Hartford, Conn.

Incinerate the Rats and Set Idle Men to Work

Recently I read an article about Riker's Island in your magazine. In this appeared the statement that the island is infested with rats. Huge incinerators would do away with this nuisance and a profitable business could be established. The City of New York would like to help its unemployed, and this is one way it could be done, at the same time eradicating the rats, which are estimated at about 15,000,000. Heat from the incinerators could be used to grow quantities of Easter lilies, thus paying the cost of operation. By this

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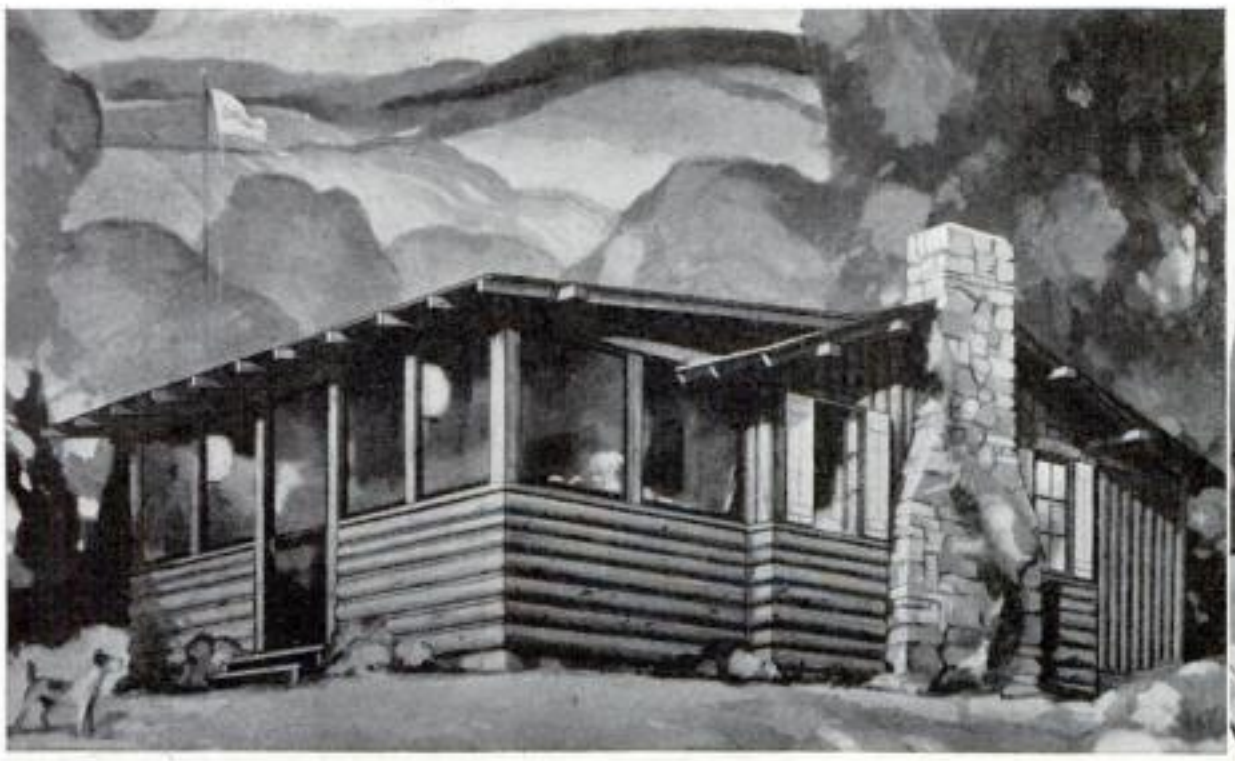

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Cabin is 16x20 feet with 9 foot 8 inch porch.
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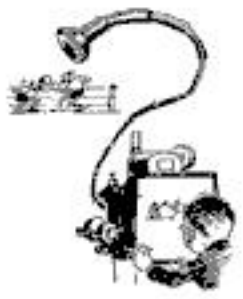
means of garbage disposal the beaches would not be polluted, the island could be made fertile, the rats would be destroyed, men would be put to work, flowers would blossom, and the world would be a better place to live in.—B.E., Union City, N. J.

Television Is Derided as Most Improper Word

First I must introduce myself. I am an electrical and mechanical engineer. For many years I was a wireless and radio designer. I spent about four years doing photographic research work. The only mechanical eye I ever had much to do with was found to be entirely practical. This is the lens, shutter, and aperture of the camera. When the light reflected from objects is allowed to pass to the plate a chemical change in the plate follows. When we open our eyelid the action is like that of the lens, but the light is concentrated upon the nerve center; or, as it is called, the retina. The rapid action of the lens, shutter, and retina of the eye causes vision. Could we really manufacture an apparatus to replace the eye, the blind would be able to enjoy sight. For motion pictures technicians use the term cinematograph, meaning many pictures in motion. Tele is the name used by the technician meaning distance. Hence the word television is the most improper term ever devised and used for scientific purposes. The only vision that can possibly take place is at the eye. The correct technical term no doubt should be telecinematography. This really works quite well but television can never work except through the telescope. When science devises a means by which the blind may be enabled to see we may well call it vision.—H.D.F., San Francisco, Calif.



Everything Just Right for This Constant Reader

Popular Science Monthly is really a wonderful magazine. I haven't any special hobbies, so I read the carpentry and the aviation articles with the same enthusiasm. Every article seems to give me something new, something I hadn't known before, and is written so that it can be understood by anyone who is able to read. The questions that Mr. Mok asks Dr. Poffenberger are questions that anyone would ask, and the doctor's answers are also very easily understood. Let me say again that your magazine is really marvelous, and that you can count me one of your readers forever.—E.L., Jersey City, N. J.

All the World Was Small in Those Queer, Ancient Days

Apropos the letter from L.A.N., about Noah's Ark and the animals: Some years ago there was a great earthquake in Japan. Suppose there had been no modern means of communication—wouldn't the earth, to the Japanese, have been only as big as their eyes could see or as they could travel on foot; and wouldn't two of each of the animals from their restricted "world" fit into some kind of ark? Does not modern discovery practically prove that the flood of Noah's time was of a rather local nature? Was not the Old Testament written at a time when learned men knew less about the size of the earth than school children do today?—A.E.H., Brooklyn, N. Y.

Last Straw, Plus the Load, Snapped Camel's Back

In reply to H.H.'s letter in a recent issue, I wish to say that neither the straw alone nor the load alone could break the camel's back. It took both of them. The load, with the addition of the "last straw," broke the camel's back.

This leaves us as the "Seven Unsolved Mysteries" of the world the following: The trisection of the angle. Perpetual motion. Women. Life. Hash. Einstein's theories. The old question of: "Which came first, the chicken or the egg?" On only the last one will I venture a solution. I believe the chicken came first.—T.P., Rochester, N. Y.

Facts About "Ghost Fleet" Come from Headquarters

I read with much interest the article on the "Ghost Fleet" in the February number of Popular Science Monthly and its complimentary references to my work. There are several points to which I should like to draw your readers' attention and which I think they would like to know. As far back as 1913 I was controlling a boat that traveled thirty-six miles an hour, and this with absolute accuracy. This control was demonstrated in official tests to the Chief of Coast Artillery. In 1916 I controlled a larger thirty-three-mile-an-hour craft from an airplane 10,000 feet up and five to seven miles distant. These demonstrations were also made to the Government. At this time I controlled a searchlight on the radio-dynamic carrier, mine dropping mechanism, smoke-producing mechanism, signal lights, the main propelling machinery, and the steering gear.

My work actually started about 1910 and has been covered by some 175 United States patents. The present "Ghost Fleet" is operated under my patents and the Navy Department has a license from me. You may also possibly know that my system has been successfully used in the control of standard submerged torpedoes running at forty to forty-five miles an hour. All these facts are open to the public, so I am able to bring them to your attention.—John Hays Hammond, Jr., Washington, D. C.

Ready to Build Set and Talk Around the World

I agree with H.M.M., of St. Louis, Mo., who requested articles on electric motors. I read the article "You Can Talk Around the World," by John Carr, and found it exceedingly interesting. I shall endeavor to build the set described and learn the code. I believe that a continuation of these articles by Mr. Carr would prove invaluable to your readers.—E.L.J.P., Portland, Ore.

Only Relativity Can Help Solve Piston Problem

I note that "E.W.D." raises the question of the duration of the moment of reversal of two engine pistons, one of which is running one hundred times as fast as the other. This is a real "relativity" problem. When we assume absolute time and space, we get into dimensionless points, durationless instants, and other contradictions. By absolute space, in this case, we mean that we can assume that the cylinder is at absolute rest in the universe, and that the piston has no motion except reciprocation. Relativity points out that our assumption does not correspond with anything in real nature. Our engine, if real, must be on the earth's surface, and the earth is not at rest. Hence the answer to this problem may be stated thus: The engine at rest is an engine that cannot exist in nature; and it is only in this impossible engine that the piston comes to a durationless stop at a dimensionless point. In the real engines, neither piston "stops" in any real sense.—R.E.A., Chicago, Ill.

Do You, Too, Want Articles on the Great Outdoors?

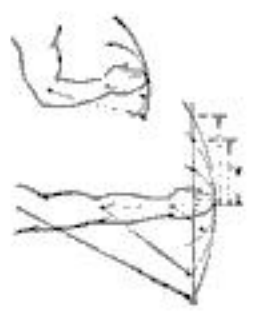
For years I have been a silent though conscientious reader of Popular Science Monthly. I have never yet offered any complaint (there could be none), nor have I tendered any advice or suggestions. I have a stack of your magazines reaching nearly to the ceiling and have read every word in the pile. Now, what I would like to do is to touch upon a few points which are of interest to me. Continue and enlarge your articles on amateur wireless telegraphy. Print an article on simple and efficient portable short wave receivers and transmitters. Enlarge your (our) magazine so as to include a few articles on subjects pertaining to the great outdoors. Above all, hand us down some good, digestible dissertations on rifles and pistols, particularly in regard to gunsmithing. Another thing: why limit that index to the home workshop department? Why not index the whole magazine, which contains a valuable store of reference material on practically any and every subject. I don't believe that anyone would object to an index covering the years preceding 1931.—M.D.G., Shenkleyville, Pa.

That's Some Job You're Trying to Hand Us

Have read with interest requests in your column for more articles on automobiles. Surely this should receive your consideration. Statistics show that forty percent of the public's dollar was this year spent in the automotive industry. Your Institute spends time in "Protection for the Buyer" for buyers of approved tools, radio, and oil burners, etc. Believe, with the many new models of automobiles now being introduced with "downdraft carburetion, simplified free wheeling, and wizard control," these things should be explained and your recommendations given. Everywhere we go billboards tell us to use this or that oil. What is the average car owner to believe? Just this information alone would be of much interest. Gus and Joe are great, keep them up, but give us more. —L.A.F., Minneapolis, Minn.

Here Are Two "Why's" for You Tool Experts to Answer

There are two "why's" that have always puzzled me. First, why does a long handled screw driver turn a screw more readily than a short one? Where is there any difference in leverage? Second, why is a close grip surer than a looser one? I always grab a tool close for fussy short cuts and feel I'm safer if it slips. I think I've explained the second question in the diagram shown here. The shorter the grip, the shorter the radius of the arc that the tool will describe if it slips. What I mean is, if the tool slips and follows the arc, it leaves the direction of force more quickly on the small circle and hence cannot slip through so great a distance, with the result that it cannot do so much damage. Am I right?—C.B.W., Ithaca, N. Y.



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IN FIXTURES specially designed for their use, MAZDA Sunlight Lamps have won popular favor not only in homes where young and old can be radiated daily with health-maintaining ultra-violet, but in hospitals and public institutions of all kinds.

In the Maryland General Hospital, Baltimore, a battery of MAZDA Sunlight Lamps burn eight hours a day, that child patients may never want for the ultra-violet radiation which the hospital physicians feel contributes to quick recovery. In St. Alexis Hospital, Cleveland, MAZDA Sunlight Lamps have been used with gratifying success in over 200 post-operative cases. In Far Rockaway, New York, this new discovery of science is being prescribed for the little tots in the Hebrew Kindergarten and Infants' Home...And, so too, we could tell you about installations in hotels, apartment houses and restaurants that give evidence of the fact that MAZDA Sunlight Lamps have won acceptance.

Now is the time you most need ultra-violet radiation. If your resistance is ever low, it is after months of sunless winter. With MAZDA Sunlight Lamps you get ultra-violet radiation equivalent to the *best midday midsummer sunshine*—and just as safe. No noise or smoke—no need of goggles. You can enjoy it while you shave, bathe or rest.

Twenty manufacturers listed below make special fixtures required for the use of this lamp. There are attractive wall and ceiling fixtures, as well as floor and table models, selling for about one-half last year's prices. "Ultra-Violet for Everyone" tells about MAZDA Sunlight Lamps and illustrates many of the fixtures available to help you get ultra-violet now —when you need it most.

A GUARANTEE OF RELIABILITY. This emblem is a guarantee that the fixture to which it is attached has been tested and approved for illumination and ultra-violet effectiveness when used with the MAZDA Sunlight Lamp (Type S-2). Purchasers should look for this emblem when buying fixtures for the MAZDA Sunlight Lamp.

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565 East Larned St., Detroit, Mich.

CURTIS LIGHTING, INCORPORATED,
1123 West Jackson Blvd., Chicago, Illinois

DOMINION ELECTRICAL MFG. CO.,
712 Ontario Avenue, W., Minneapolis, Minn.

J. M. FELDMAN CO., INC.,
740 South Wall Street, Los Angeles, Cal.

THE FRINK CORPORATION,
23-10 Bridge Plaza South, L. I. C., N. Y.

GENERAL ELECTRIC COMPANY,
Merchandise Department, Bridgeport, Conn.

THE EDWIN F. GUTH COMPANY,
Jefferson & Washington Aves., St. Louis, Mo.

HEALTHMASTER SUN RAY LAMP DIVISION, LIBERTY ELECTRIC CO.,
50 West North Street, Indianapolis, Ind.

HOLOPHANE COMPANY, INC.,
342 Madison Avenue, New York, N. Y.

THE KAYLINE COMPANY,
600 Huron Road, Cleveland, Ohio

LIGHTOLIER COMPANY,
569-575 Broadway, New York, N. Y.

LUMINATOR, INC.,
851 Washington Blvd., Chicago, Ill.

THE MILLER COMPANY, Meriden, Conn.

MOE-BRIDGES COMPANY,
220 North Broadway, Milwaukee, Wis.

MUTUAL SUNSET LAMP MFG. CO.,
Empire State Building, New York City

S. ROBERT SCHWARTZ & BRO.,
160 Varick Street, New York, N. Y.

THE F. W. WAKEFIELD BRASS CO.,
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POPULAR SCIENCE
MONTHLY
April 1932 Vol. 120, No. 4
RAYMOND J. BROWN, *Editor*

Radium Strike in CANADIAN WILDS

HERE IS YOUR AUTHOR IN THE FAR NORTH

McLeod pitched his tent on the shore of Echo Bay, Great Bear Lake, and studied the rich pitchblende fields there. At right, flagship of Western Canada Airways fleet taking on sample of radium-bearing ore at Great Bear Lake

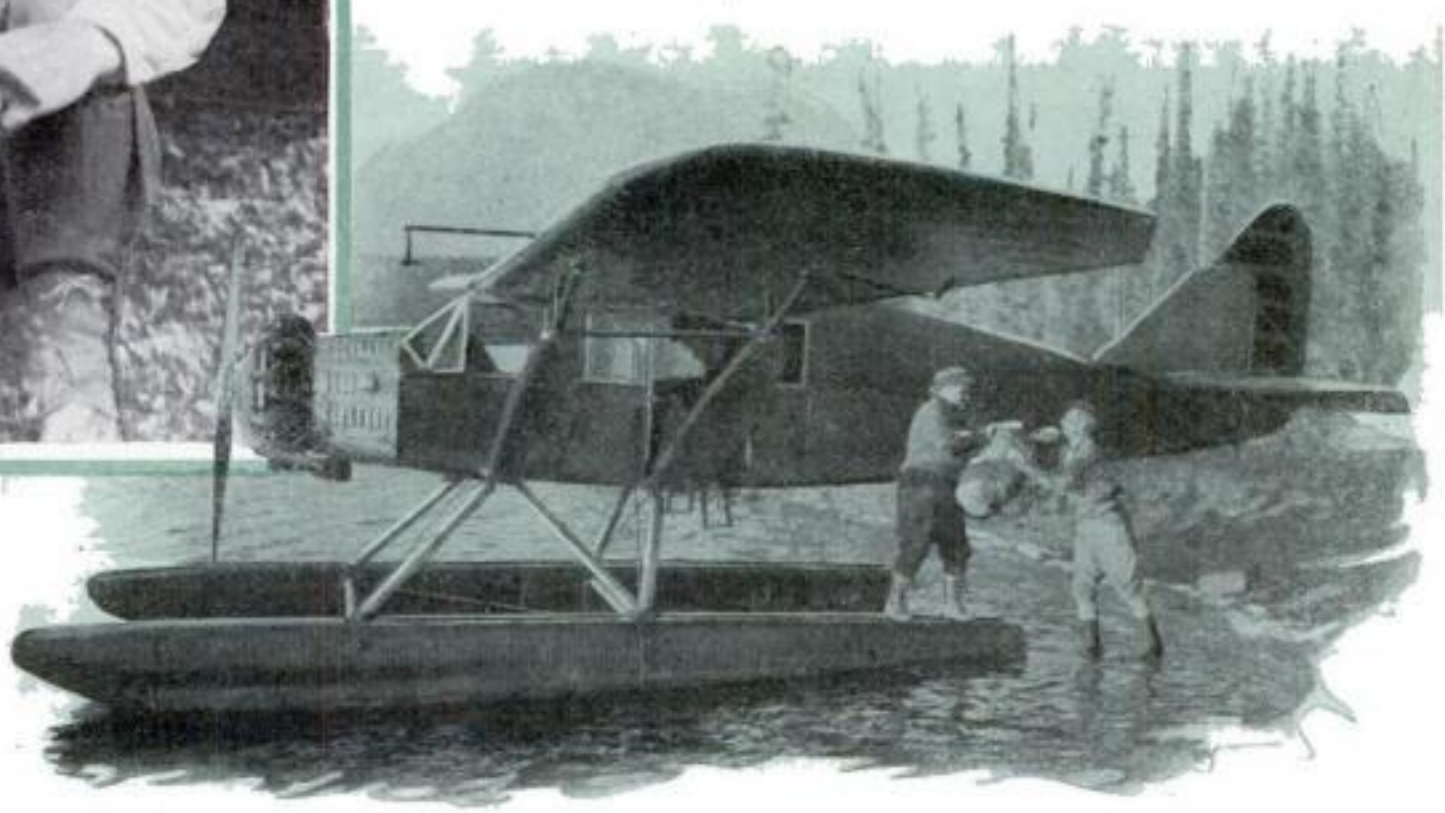
Prospectors Rush by Plane to Rich New Treasure Field

By CHARLES MCLEOD

A RICH man's rush! That is what this migration of mining engineers, geologists, and prospectors, sweeping by airplane into the Great Bear Lake region of Northwest Territories, Canada, is called. Not gold but radium is the prize; and radium is worth, ounce for ounce, a hundred thousand times as much as gold!

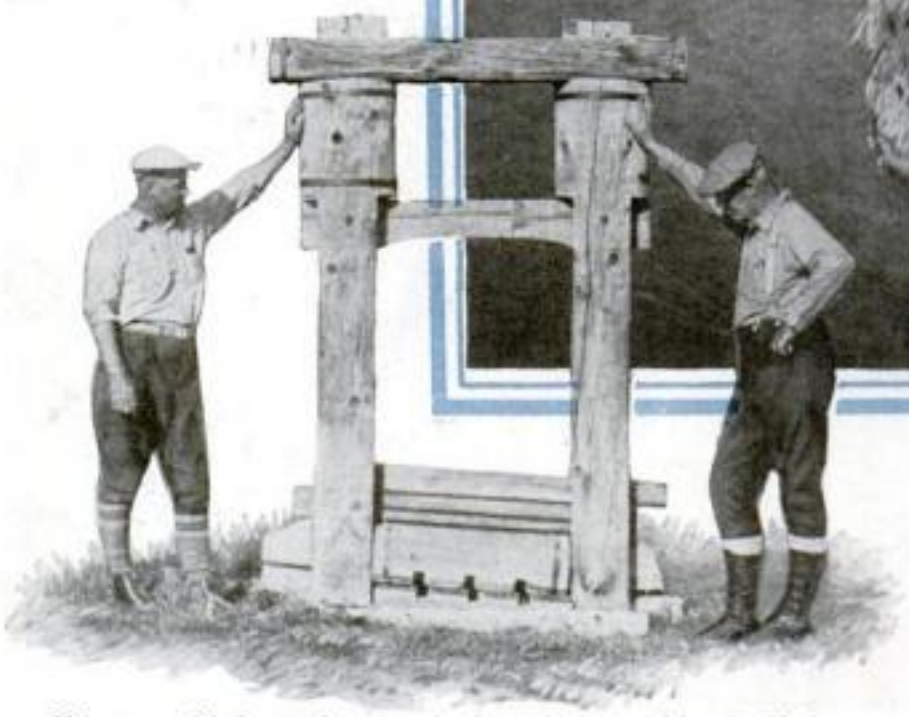
Pitchblende, a radium-bearing substance, has been found in that remote region. I have seen it, and early last winter I brought back to civilization from the Northern wilderness specimens of this black ore. Up in the Great Bear country there are also silver veins so rich that some assays show half the weight of the ore is silver! Not all of it will be so rich, but at worst it is so valuable that I am convinced it will, in time, put Great Bear in the front rank of the world's silver deposits.

Gold? That is one of the things I am going back to look for. Certainly there is gold. We know that assays from some of these veins run high in gold, and my own opinion is that we have barely scratched the edge of one of Nature's great stores of raw treasure.



MINERAL LEDGE AT GLACIER BAY

This airplane picture shows the narrow entrance to Glacier Bay and the mineralized "breaks" in the formation. The hill, right foreground, is almost 300 feet high and is full of valuable ore



Years ago this heavy framework of wood was used by the Hudson's Bay Company fur traders to bale furs sent out in canoes

There is an abundance of copper and other of the less precious metals; but the high hopes of the flying prospectors of the North are centered on radium. In all the world men have at their disposal a little less than two pounds of this extraordinary mineral. Its great value lies in its use in the treatment of the worst of all human scourges, cancer; but its high price is due to its rareness. It is one of the least plentiful substances known to man.

One of the possible results of the pitchblende discoveries at Great Bear Lake is that radium will become cheaper and therefore more widely available to physicians. In American hospitals there is an immediate, life-saving need for at least three times as much radium as is known to exist in all the world. Is it any wonder that those of us who were given the chance to fly into the Great Bear Lake region last summer were excited?

I got my chance because I am a prospector and understand the trick of living in the Canadian wilderness. When the first news of the big strike in the Northwest Territories swept over Canada last year I wanted to go, but how was I to get into that remote region before the most likely ground had been staked by other prospectors?

IT COSTS a lot of money to pay for an airplane ride into such a region. The cost of transporting grub and other prospecting equipment into the Great Bear Lake country is $1.50 a pound, and I knew I would need the better part of a ton of materials to sustain myself and do effective work up there under the rim of the Arctic Circle.

Just when I was feeling a bit hopeless about it I got a telegram from an outfit with whom I had been associated. They wanted me to go into the field as their prospector. They would pay the freight and I would take the risks and hardships. It was a fair proposition.

The wire told me to catch the night train at Toronto for Edmonton, Alberta, where a plane had been chartered for me. Minutes counted, as they always will count hereafter in any rush to the scene of newly discovered mineral deposits.

There are many prospectors in Canada. It is not generally appreciated in the United States that to the north a third of the continent remains in a state of nature. There is hardly a year that does not see a mining rush. Cobalt, Sudbury, Porcupine, Rouyn, Red Lake, Flin Flon —all these and other mining towns were once just places in the wilderness that stirred the blood of prospectors as now it is being stirred by Great Bear Lake.

It was ten o'clock on the morning of September 7, 1931, when our plane took off from Edmonton, bound for the scene of the radium strike! We were interested also in the news of rich silver veins, the known occurrence of copper, and the possibility of gold. My two companions were men hired to do the ax work.

The plane was a big, single-engined Fokker. The Canadian Airways pilot was Archie McMillan. In the fuselage was packed an assortment of hastily assembled materials—tents, a thirty-thirty carbine, ammunition, picks and shovels, axes, and dried food consisting of powdered milk, powdered eggs, and dehydrated potatoes.

Quite commonly now the 1,300 miles between Edmonton and Great Bear Lake is flown in the course of a single day; because of fogs and other mishaps it took me from the morning of September 7 until noon of September 12.

Is Belgium's Radium Trust Doomed?

TODAY Belgium holds a world monopoly of radium, the almost priceless mineral used largely in combating the dread disease cancer. By limiting the output from its rich South African fields, according to the American Chemical Society, Belgium has maintained the exorbitantly high price demanded for the mineral. In this connection the journal of the American Chemical Society says: "In Canada there have been found at La Bine Point, in the Great Bear Lake Region, very important deposits of pitchblende. The richness of this ore indicates that here is a deposit able to match itself against that from South Africa. The men who own it are primarily interested in the humanitarian use of radium. As a result of this discovery, radium may soon be available for the trained men who are skilled in its use and capable of applying it for the alleviation of human suffering." It is of this pitchblende strike in far northern Canada, from which the first ore has come in planes, that this article gives a thrilling first-hand account.

GASOLINE READY IN NORTHERN WILDS

Western Canada Airways has established this cache of gasoline at Fort Resolution on Great Slave Lake, and here planes heading for the mineral fields take on final supply of fuel for the flight. Below, map shows flying route from Edmonton to Echo Bay on Great Bear Lake, near Arctic Circle

We had flown only seventy-five miles that first morning when fog and rain forced us down. In the afternoon we made another forty miles only to be forced down for the night. Two hours of flying the next morning brought us to Ft. McMurray, where we gassed up and I bought moccasins, snowshoes, and other utensils necessary to a prolonged stay in the bush of the north country. All this made a heavy load, and for four hours we waited for a breeze to overcome the drag of our pontoons.

WE MADE fifty miles on the next flight and then a valve of the engine blew through a piston head. Up 2,000 feet with a dead engine! But Pilot McMillan maneuvered that heavily laden craft safely down from the skies to the surface of the Athabaska River. It was a magnificent piece of work.

How do you get another airplane to come to the aid of one disabled in the Canadian forest? Fortunately we had come down close to a post of the Hudson's Bay Company, and there we waited while an Indian in a canoe driven by an outboard motor carried Pilot McMillan's message to the nearest wireless station. I had eaten my second breakfast at the factor's table before we heard the drone of Walter Gilbert's plane, the famous S. K. Quickly my duffel was shifted into this veteran machine and after two days of aching delay we resumed our journey. A few hours later we landed at Ft. Smith, a real outpost of the wilderness.

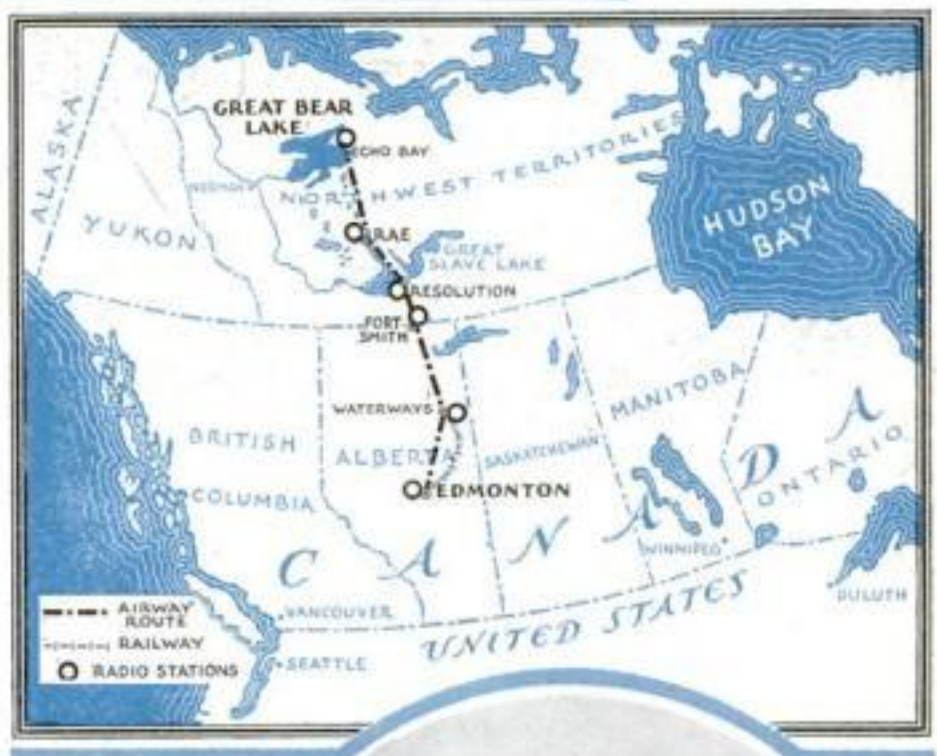
The law of the Northwest Territories is manifest there in Commissioner of the Royal Northwest Mounted Police. He is a red-coated representative of the king whose responsibility extends clear to the top of the world. More important in my eyes was the Mining Recorder, with power to issue licenses to prospectors. Each of us could have three of these documents.

That made nine for my party, and since each license carries with it the right to stake six claims, we were therefore licensed to stake a total of fifty-four claims. As a claim is 1,500 feet square, this meant staking rights for a total area of about 2,700 acres. Before we left Ft. Smith I bought some parkas, fur-lined tunics to be drawn over the head in the fashion of turtle-neck sweaters with hoods to protect the wearer's head. Two hours for these transactions and again we were in the air flying toward Rae, which lies north of Great Slave Lake.

Halfway to this body of water, which is a brother in size to Lake Erie or Lake Ontario, we ran into fog again. For more than a hundred miles we flew not much above the tree tops, but by the time we reached the southern edge of the lake the blanket of fog had lifted so that we started across.

It is 250 miles across that lake at its widest portion, and that is where we crossed it. We had gone not much more than half of the distance when fog, thick as a mountain range, came rolling out to meet us. We had so little gas it was too risky to take the chance of getting lost, and so we scuttled back, landing at Fort Resolution on the southern shore.

I was never more impatient than when I awoke the following morning and looked out into thick weather. I was still far from my goal after four days of trying; but this was a lucky delay. A plane droned out of the north, and, diving to the lake, taxied up to us. It was Punch Dickens, who had been flying between Great Bear Lake and Edmonton all summer. This time his passenger was the one man in the world I wanted to see. He was a mining engineer, member of the syndicate I represented, and it was his preliminary reports that had resulted in the decision to send me into the field. "It looks better than I had hoped," he said. "Nothing you may have heard can be an exaggeration. You'll be getting an early start."



Bears and wolverenes rob the prospectors of their supplies if they are left on the ground, so a high cache, like the one above, is built and food is stored in it

I had time to arrange with Punch Dickens to have another plane pick up more grub that I intended to buy at Rae and then, a little later, we were in the air. We spent that night in Rae, where I bought several hundred pounds of oatmeal, dried vegetables, and beans. It was the morning of September 12 when we took off for the final run to Great Bear Lake. It was noon when we dropped down on Glacier Bay. We had arrived!

(Continued on page 124)

America *to* Rule Sea *with*

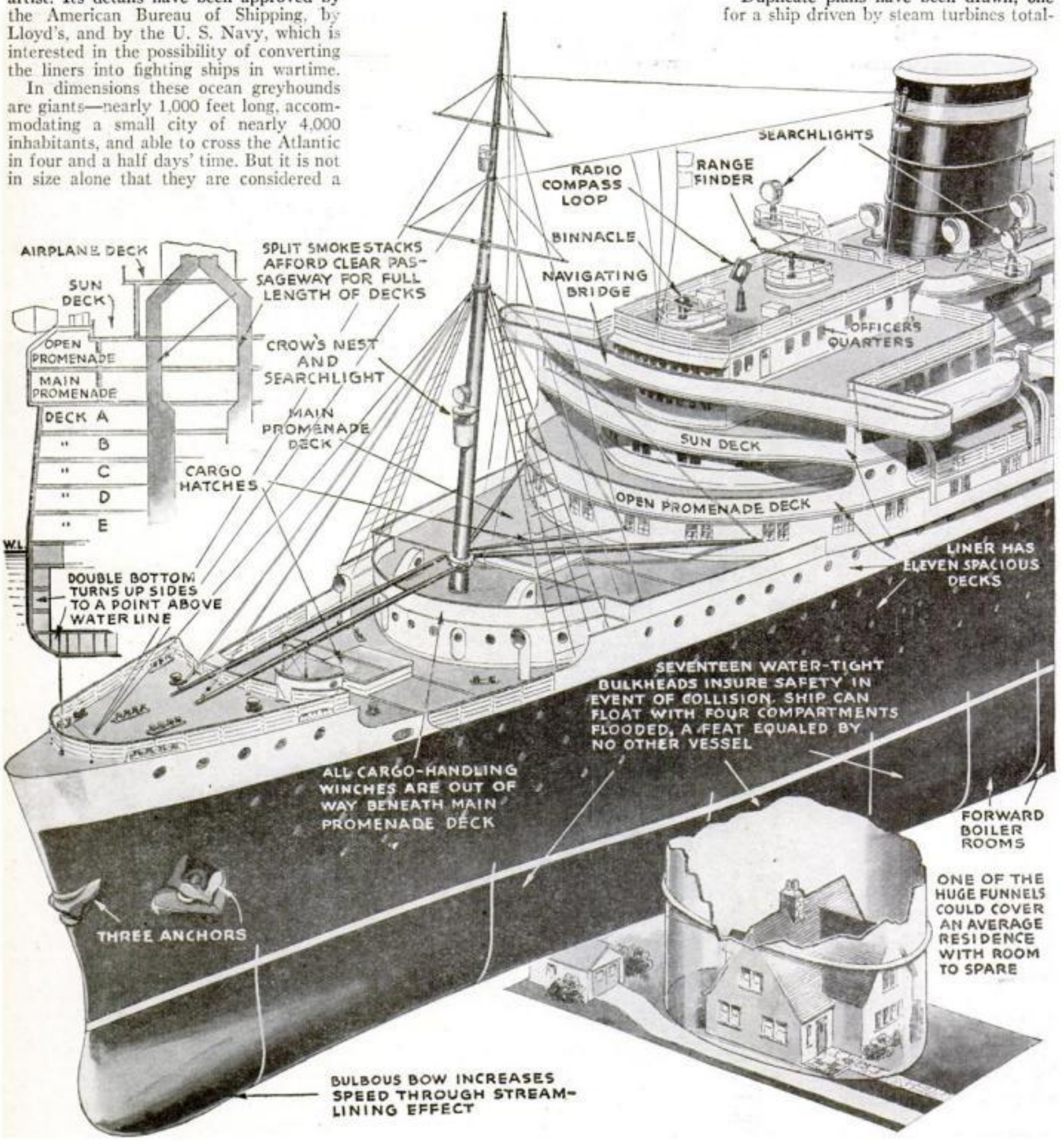
COMPLETED plans have just been announced for superliners that may bring back to America's merchant fleet the supremacy of the seas. Construction of the "blue ribbon" fleet for transatlantic service is proposed by the United States Lines, subject to the enactment of favorable legislation by Congress. Tests of twenty-foot models in the Navy's experimental basin at Washington, D. C., have led to the design now announced and presented here by our artist. Its details have been approved by the American Bureau of Shipping, by Lloyd's, and by the U. S. Navy, which is interested in the possibility of converting the liners into fighting ships in wartime.

In dimensions these ocean greyhounds are giants—nearly 1,000 feet long, accommodating a small city of nearly 4,000 inhabitants, and able to cross the Atlantic in four and a half days' time. But it is not in size alone that they are considered a notable triumph of engineering design.

The sinking of the *Titanic* aroused the world to the need of greater safety at sea. Water-tight bulkheads, walling off compartments that may be ripped open without sinking a ship, have been recognized as a prime safety need. Successively ships have been built that could float with one, two, and even three water-tight compartments flooded. But the new liners will float safely with four of these walled-off compartments open to the sea.

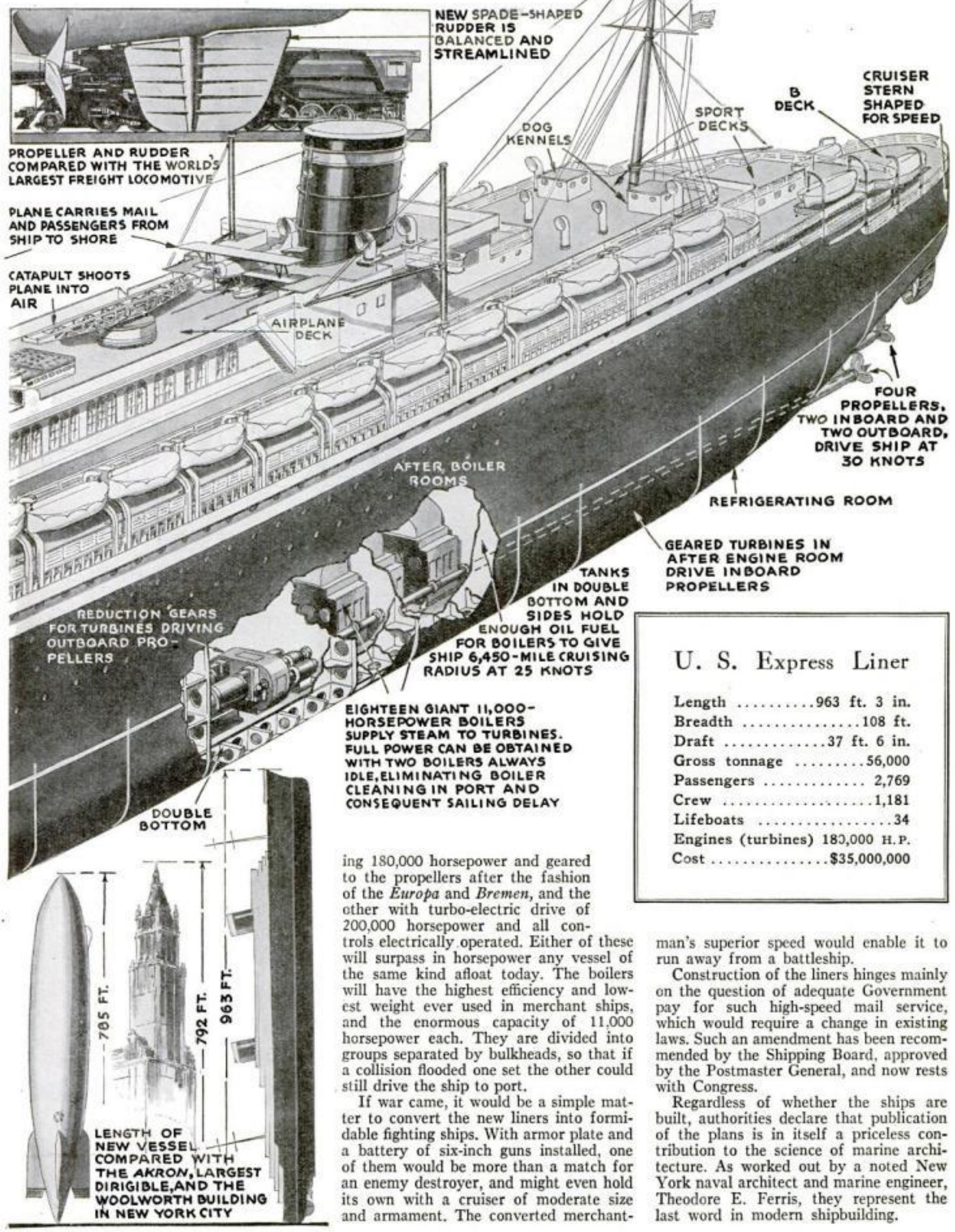
Everything about the liners is designed for speed. They will have the bulbous bow and the cruiser stern with which the German liners, *Bremen* and *Europa*, won transatlantic speed laurels. Decks are shaped to reduce wind resistance. An innovation is a spade-shaped rudder of a new streamline design. No passengers will be carried at the forward end because the high speed at which the liners would plow through the water would often subject them to buffeting and spray.

Duplicate plans have been drawn, one for a ship driven by steam turbines total-



New Superliners

Drawing by
B. G. SEIELSTAD



U. S. Express Liner

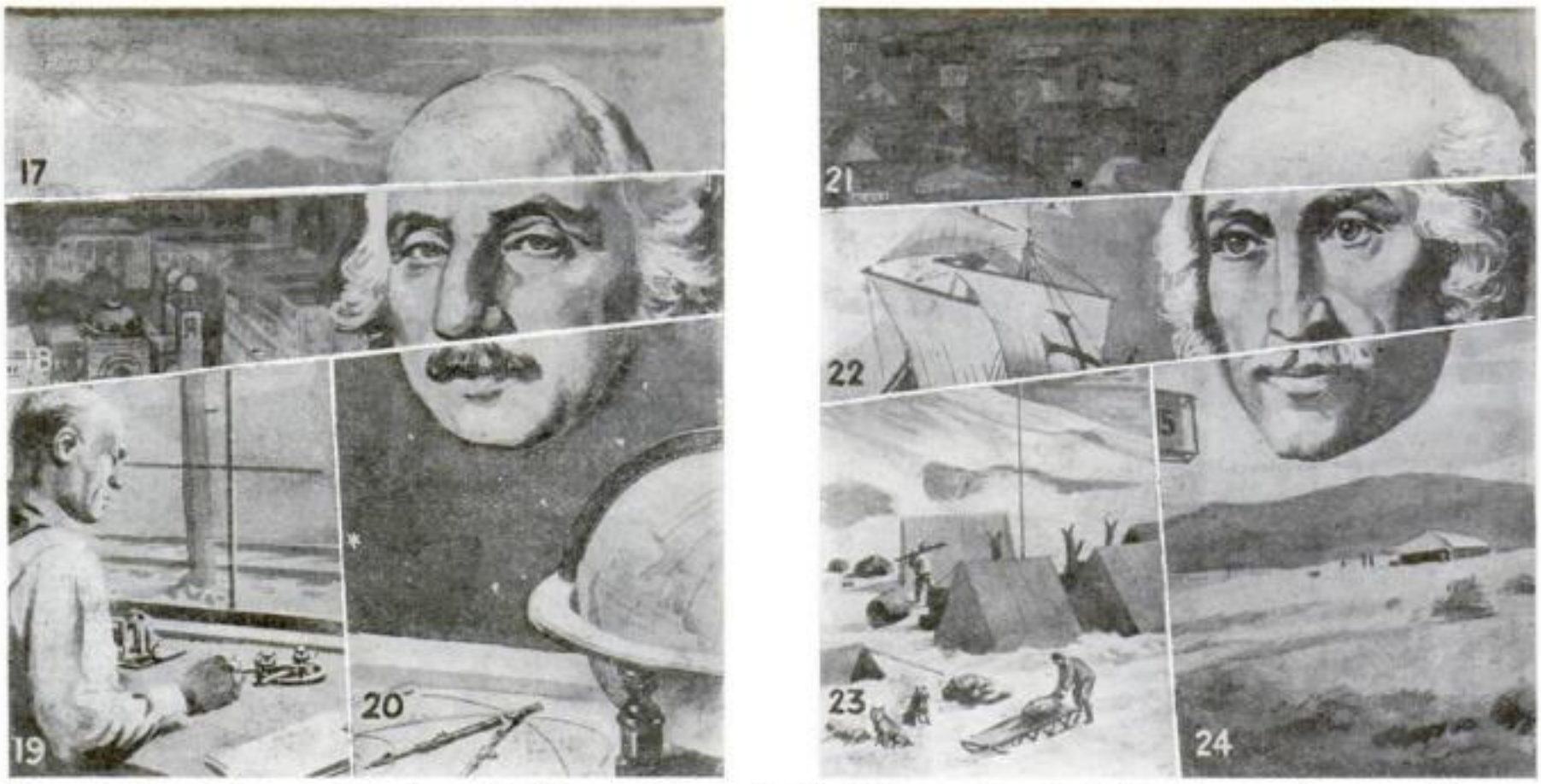
Length	963 ft. 3 in.
Breadth	108 ft.
Draft	37 ft. 6 in.
Gross tonnage	56,000
Passengers	2,769
Crew	1,181
Lifeboats	34
Engines (turbines)	180,000 H.P.
Cost	$35,000,000

ing 180,000 horsepower and geared to the propellers after the fashion of the *Europa* and *Bremen*, and the other with turbo-electric drive of 200,000 horsepower and all controls electrically operated. Either of these will surpass in horsepower any vessel of the same kind afloat today. The boilers will have the highest efficiency and lowest weight ever used in merchant ships, and the enormous capacity of 11,000 horsepower each. They are divided into groups separated by bulkheads, so that if a collision flooded one set the other could still drive the ship to port.

If war came, it would be a simple matter to convert the new liners into formidable fighting ships. With armor plate and a battery of six-inch guns installed, one of them would be more than a match for an enemy destroyer, and might even hold its own with a cruiser of moderate size and armament. The converted merchantman's superior speed would enable it to run away from a battleship.

Construction of the liners hinges mainly on the question of adequate Government pay for such high-speed mail service, which would require a change in existing laws. Such an amendment has been recommended by the Shipping Board, approved by the Postmaster General, and now rests with Congress.

Regardless of whether the ships are built, authorities declare that publication of the plans is in itself a priceless contribution to the science of marine architecture. As worked out by a noted New York naval architect and marine engineer, Theodore E. Ferris, they represent the last word in modern shipbuilding.



Cut out these pictures along the white lines and you will find it easy to put eight parts together to make two

$10,000 *in* CASH

Here Are Two More Heroes of Science

HOW would you like to stay home tonight and, with a pair of scissors, earn $500?

You have a chance to win that sum, and much more besides, by competing in our six-month Picture Puzzle Cut-Out Contest, which began last month and will continue until August.

This fascinating and instructive game, which everybody, regardless of age or sex, can play, has aroused unusual interest. Entries in last month's contest are being received in large numbers, and the first decision of the judges will be announced as soon as possible. If you were one of those who competed last month, compete again this month, for there is nothing to keep you from winning a prize each month. If you did not take part last month, BEGIN NOW.

Each of the six months of this "scissors tournament," POPULAR SCIENCE MONTHLY will award twenty-nine cash prizes to a total of $1,000. In addition, seventy-one Grand Prizes, to a total of $4,000, will be awarded at the close of the contest. Monthly prizes range from $500 to $10. Grand Prizes range from $2,000 to $10.

Here is the way our new game is played: Above are composite pictures of Heroes of Science and Their Accomplishments. The features of these great men, and the pictures of the events or accomplishments that surround their names with world-wide fame, are all mixed up. Which Heroes of Science are they? And what were Their Accomplishments?

As you see, each of the pictures is divided into four parts, sixteen parts in all. The pictures are so arranged that, when you cut out all of the parts and reassemble half of them in the correct manner, you will get TWO COMPLETE PICTURES of Heroes of Science with eight parts left over.

Assembling the cut-outs correctly is not a difficult task. If you are alert, and take the clues to the identity of the Heroes and the hints as to their Accomplishments which we will give you, you will solve the puzzle without much effort and in a minimum of time.

Prizes will be awarded to contestants who submit the two correct pictures, assemble and mount them in the neatest and most skillful manner, and state the name and accomplishment of each of the two Heroes of Science in twenty words or less. The Monthly Prizes, totaling $1,000, will be awarded on this basis.

AFTER you have sent in your TWO COMPLETE PICTURES to compete for the monthly prizes, you will have EIGHT CUTTINGS LEFT OVER. Keep these left-over cuttings, for they will give you TWELVE ADDITIONAL COMPLETE PICTURES of Heroes of Science, provided you have kept the left-overs from the beginning of the contest. These left-over cuttings must be kept by the contestants throughout the six months of the contest, and the additional TWELVE PICTURES must not be sent in until the close of the contest, when the Grand Prizes will be awarded. Submit only TWO COMPLETE PICTURES, in which no left-over cuttings are used, in competing for the Monthly Prizes. In other words, the TWO COMPLETE PICTURES you send in this month should be assembled from the cuttings numbered from 17 to 32 inclusive.

To compete in this contest, you need not be a subscriber or regular reader of POPULAR SCIENCE MONTHLY. It is not necessary to buy the magazine. You may borrow a copy from a friend and see either the current or last month's issue at the Public Library and trace or copy the pictures. You are permitted to get all the help you need from relatives, neighbors, or friends, and you may submit as many entries in each contest as you please. Before starting work on this month's pictures, read the rules of the contest on the opposite page.

MONTHLY PRIZES

First Prize	$ 500
Second Prize	100
Third Prize	50
Six Prizes, $25 Each ..	150
Twenty prizes, $10 Each	200
Total	$1,000

GRAND PRIZES

First Prize	$2,000
Second Prize	500
Third Prize	200
Three Prizes, $100 Each	300
Five Prizes, $50 Each .	250
Ten Prizes, $25 Each ..	250
Fifty Prizes, $10 Each .	500
Total	$4,000

pictures. Eight parts will be left over. Save these carefully to use in making pictures for the Grand Prize Contest

PRIZES FOR SOLVING NEW AND EASY PICTURE-PUZZLES

Henry Ford, pioneer in mass production of low-priced autos

Steinmetz, wonder-worker in development of electricity

Einstein, whose work changed ideas regarding universe

Admiral Peary, famous explorer, discovered North Pole

Orville Wright, co-inventor of airplane and first to fly one

Washington: in his administration Patent Office opened

The Men Whose Pictures Can Be Completed Are in Above Group

Rules of This Contest—Read Carefully

1. Each month, for six months, beginning last month, POPULAR SCIENCE MONTHLY will print four composite pictures of Heroes of Science and Their Accomplishments. Each set of pictures, when cut apart and assembled correctly, will make two complete pictures with eight parts left over.

2. The pictures must be pasted together. The monthly prizes will be awarded to those contestants who assemble the pictures correctly and in the neatest and most skillful manner. Each of the two complete pictures must be accompanied by twenty words or less, identifying the Hero of Science and his accomplishment.

3. Answers to each monthly contest must be mailed or delivered to the offices of POPULAR SCIENCE MONTHLY not later than the thirtieth of the month following the date of publication of the magazine in which the pictures appear. Thus, solutions of the puzzle in this month's issue must be mailed or delivered not later than April 30.

4. At the close of the six monthly contests, there will be a final contest for Grand Prizes. To compete for these, contestants must carefully save the cuttings left over from the monthly contests. These left-over cuttings, during the six months, will produce twelve additional complete pictures of Heroes of Science and Their Accomplishments, if assembled in the correct way. These additional pictures must not be submitted during the progress of the monthly contests, but at their close. Entries for the Grand Prize contest must be mailed or delivered not later than the thirtieth of the month following the date of publication of the magazine in which the pictures for the last monthly contest appear. This will be the August issue, published July 2. Entries for the Grand Prize contest, therefore, must be mailed or delivered not later than August 30.

5. To receive consideration for the Grand Prizes, contestants must submit not less than twelve additional complete pictures.

6. Grand prizes will be awarded to those contestants who assemble the twelve additional pictures correctly and put them together in the neatest and most skillful manner. Each of the twelve pictures must be accompanied by twenty words or less, identifying the Hero of Science and his accomplishment.

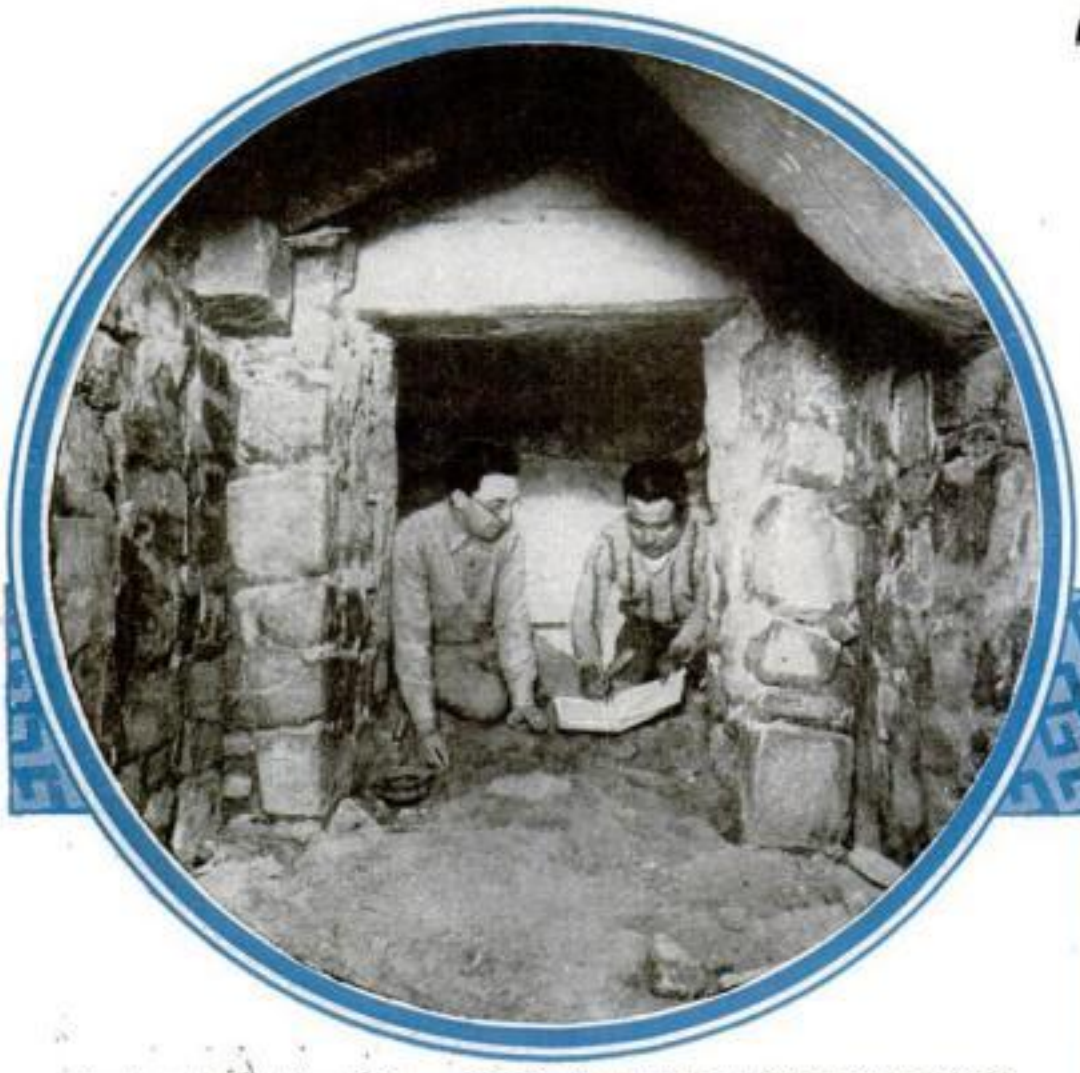
7. In case of ties each tying contestant will be awarded the prize tied for. This rule will be observed in the monthly contests as well as in the Grand Prize contest.

8. All entries should be addressed to the Heroes of Science Contest Editor, POPULAR SCIENCE MONTHLY, 381 Fourth Avenue, New York City. Name and address of the entrant must be written plainly on each page of the entry. Entries with insufficient postage will not be accepted. The publishers cannot be responsible for delay, loss, or non-delivery of entries. No contribution entered in this contest will be acknowledged, and none will be returned. No letters of inquiry regarding points covered in the rules can be answered.

9. There is no entry fee. You need not buy POPULAR SCIENCE MONTHLY to compete. You can borrow a copy from a friend and trace or copy the pictures, or you can examine a copy of the magazine at any office of POPULAR SCIENCE MONTHLY or at the public libraries free of charge.

10. Each contest is open to everybody, everywhere, except employes of POPULAR SCIENCE MONTHLY and the Popular Science Institute and their families. The officials of the Popular Science Institute will act as judges and their decision will be final.

TOMB of *Yields Treasure*



Tomb at Monte Alban, Oaxaca, Mexico, from which a king's ransom in gold and jewels was taken by Alfonso Caso, left, and his assistant, Martin Bazan

Royal breastplate wrought of spun gold, representing ancient Mixtec warrior, taken from Monte Alban tomb by Mexican archeological expedition

By JOHN E. LODGE

TREASURE buried centuries ago, rivaling in riches the relics in the tomb of King Tut-ankh-Amen in Egypt, was unearthed a few weeks ago by Alfonso X. Caso, Mexican government archeologist. Amid the ruins of Monte Alban, a mountain fortress in the highlands of southern Mexico, Caso discovered the secret burial vault of six ancient Indian war lords, their crumbling skeletons literally covered with a wealth of gold and jeweled ornaments. Experts pronounce his find worth a king's ransom and the greatest of its kind ever made on the American continent.

Its monetary value tells only a small part of the story. Its real significance lies in the fact that the excavations may help solve the mystery of the rise and fall of the half-forgotten Mixtec and Zapotec peoples that built magnificent mountain cities at the time when William the Conqueror invaded England.

In the ancient tomb Caso and his assistants came upon the remains of the six chiefs seated around the walls, their bones hung with the glittering insignia of their rank—necklaces of gold, pearls, and other jewels; and gold breastplates, bracelets, and rings, all of expert workmanship.

The vault was strewn with works of art and odd, barbaric objects wrought in precious metals and studded with gems; some of them strangely beautiful, others ghastly and grotesque, but all rare and valuable. Among them were heavy gold crowns, sacred gold death masks, the solid gold head of a goddess, a gold eagle with a silver chain in its beak, a number of filigreed gold feathers, rock crystal bowls, jade urns, and alabaster vessels, pearls of unusual size, and pieces of amethyst, jade, and coral.

Map shows the position of Monte Alban ruins, once a stronghold of the vanished Mixtec race

Pendants, bracelets, rings, beads, rattles, cups, and vases of fantastic design, as well as articles of bronze and silver, lay heaped on the floor of the tomb. Beside one of the dead warriors, the explorers found a human skull encrusted with turquoise, a flint knife stuck through the hollow of the nose, evidently a trophy of battle. Weirdest of all was a mass of human bones, carved into curious shapes and engraved with what are assumed to be historical scenes.

The treasure tomb was the seventh Caso and his party had opened in an ancient cemetery they discovered in their exploration of the ruins of Monte Alban, near Oaxaca City, 250 miles south of Mexico City. The other six vaults also had yielded seated skeletons and a number of ornaments and pieces of pottery, but among them was little of intrinsic value.

This skull of a Mixtec chieftain was set with turquoise and buried centuries ago in the Monte Alban tomb

Undiscouraged, the excavators continued their work. As it progressed, they approached a vault at the foot of a central, 150-foot-wide grand stairway. Its location was so promising that Caso and his assistants redoubled their efforts. Aided by a small army of workmen, they labored fourteen and sixteen hours a day, removing rubble. Finally, they came to a flat carved tablet covering a secret entrance to the ceiling of the tomb. They found later that the vault's doorway had been sealed from the inside, the burial party having left through the ceiling.

Mexican "King Tut"

Buried by Long-Vanished Race

Exterior view of treasure tomb at Monte Alban, near Oaxaca City, Mexico. This was the seventh tomb opened by Caso's expedition and the first to yield treasure

At top, mask of solid gold with beautiful filigree work found by Caso. Below it, large gold necklace with bells attached. Above, string of gold beads and at left, pendant of gold with hanging gold bells. The pendant is engraved with hieroglyphics, meaning of which is unknown

Removing the tablet, the explorers entered a dim outer chamber. A pair of steps led to the tomb proper, consisting of two rooms. The first had a flat ceiling; the second was a gabled vault, about twenty-four feet long, seven feet wide, and five feet high. Its walls were inscribed with undecipherable hieroglyphics, and inlaid with pearls, jade, and other precious stones. Here the beams of flashlights revealed the six chieftains weighted down and surrounded by the dazzling collection of gems and golden trappings.

Secretly and under heavy guard, the treasures, valued at hundreds of thousands of dollars, were removed to the vaults of the Bank of Mexico in Oaxaca City. It was only after they were safely under lock and key that the sensational find was announced. An eighth tomb, entered a few days later, again yielded nothing but bones and some pieces of pottery.

The work of excavation, which started last fall, was stopped in February by the approaching rainy season and lack of funds. Caso hopes to raise sufficient money to resume his explorations in October.

Meanwhile, experts will have a chance to study the relics, which may answer a number of questions that have puzzled scientists for years. Who built and inhabited Monte Alban? When was it built and when abandoned? Who were the warrior chiefs buried in the tomb? What people did they lead in battle and whom did they fight? Where did the inhabitants of the ancient ruined fortress obtain the precious stones? What was their relation to other Mexican tribes of centuries ago?

The hieroglyphics on the urns and vessels, undeciphered so far; the strange engravings on the human bones, a ghastly, loose-leaf history book that also is said to contain dates in a hitherto unknown calendar; and details of the craftsmanship of the crowns, masks, idols, breastplates and other ornaments, may tell the story.

Until they do, Caso's discoveries deepen rather than solve the mystery. Caso himself insists that the bones in the royal tomb were those of Mixtec chieftains. Monte Alban, however, is in Zapotec territory, and the tomb itself is built in the Zapotec style, familiar to archeologists. Moreover, the relics, according to Caso, date from the sixteenth century, while both the Zapotecs and Mixtecs flourished centuries earlier. One theory offered in support of the belief that the remains are those of Mixtec chiefs is that the war lords may have headed an army in temporary control of the Zapotec fortress.

To this day, there are several hundred thousand Indians living in southern Mexico who claim descent from these ancient peoples that reached the height of their civilization when the Mayan empire, to the south, had begun to decline. Later, both Zapotecs and Mixtecs, continually at war with one another, were conquered by the Aztecs.

It is generally supposed that Monte Alban was the capital of the ancient Zapotec country. Near by lay the lands of the Mixtecs. Exactly when and where these peoples lived is not known. But scientists now believe that the earliest civilization on this continent was that of the Mayas, whose oldest records date back to about 2,000 years prior to the arrival of the Spaniards; the latest was that of the Aztecs. The Zapotecs and the Mixtecs, as well as a third nation called the Toltecs, held sway between these two periods, and attained the peak of their power, riches, arts, and crafts from the eleventh to the fourteenth centuries, A. D.

Monte Alban, according to archeological experts, was abandoned a long time before the arrival of Cortez in 1519. Today, it is one of the most picturesque ruins in Mexico. High above Oaxaca City, in the state of the same name, it consists of a system of courts, surrounded by platforms and pyramids, built on a leveled and terraced mountain top.

(Continued on page 126)

LANGMUIR wins our $10,000

POPULAR SCIENCE MONTHLY'S *Committee Selects Distinguished Physicist as Recipient of Honor for His Outstanding Scientific Achievements*

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Vice-President and Director of Research, General Electric Co.

DR. ORVILLE WRIGHT
Scientist and Inventor

THE POPULAR SCIENCE MONTHLY Annual Award of $10,000 for notable scientific achievement has been conferred upon Dr. Irving Langmuir, research chemist and physicist and assistant director of the research laboratories of the General Electric Company, at Schenectady, N. Y. Dr. Langmuir is the inventor of the nitrogen-filled incandescent electric light bulb and the atomic welding arc. The Award, together with the gold medal commemorating it, was presented to Dr. Langmuir in New York City a few days ago.

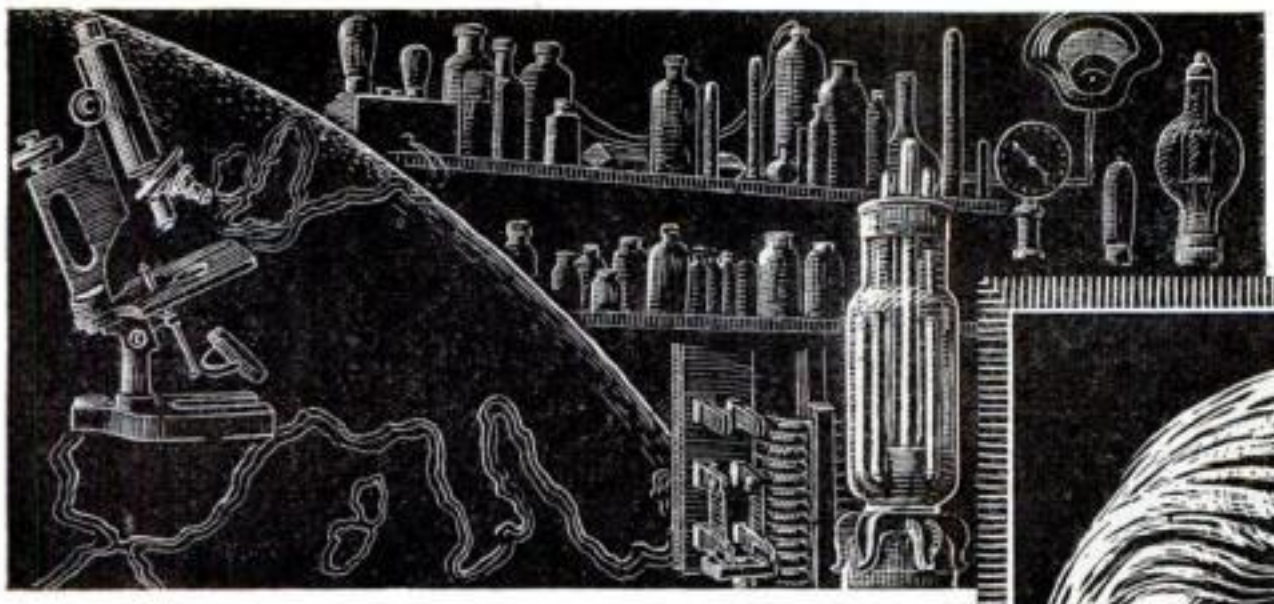
This was the second bestowal of the POPULAR SCIENCE MONTHLY Award, the largest prize for scientific accomplishment in the United States. The Award was established two years ago by this magazine for the double purpose of honoring Americans who have done notable scientific work and of stimulating the public mind to a greater appreciation of the values of scientific investigation.

Last year, the prize was awarded jointly to Dr. George H. Whipple, of the University of Rochester, and Dr. George R. Minot, of Harvard University, in recognition of their discovery and development of a cure for pernicious anemia.

Scientists throughout the country expressed deep gratification when it became known that Dr. Langmuir had been selected for the distinction this year by the twenty-two prominent men of science constituting the Committee of Award. They felt that, in bestowing the Award upon Dr. Langmuir—a laboratory worker of outstanding attainments who, nevertheless, is comparatively little known to the general public—the Committee had truly achieved, not only in letter but in spirit, the purposes for which the Award was established.

The Committee left no stone unturned in its effort to find the candidate most deserving of the honor. The entire American field of science was covered thoroughly. Every university and college in the country, all of the scientific societies, every industrial research organization, and various departments of the United States Government, nearly 1,800 organizations in all, coöperated in the search.

Shortly after the prize had been awarded for the first time a year ago, these bodies were requested to nomi-



Annual Award

nate men in their own or any other field whose work they deemed worthy of the distinction. In the ensuing months, the names of hundreds of candidates, representing virtually every department of scientific endeavor, were submitted. Numerous suggestions from individuals, among them many readers of POPULAR SCIENCE MONTHLY, further increased the large total of possibilities.

The Committee then began the prodigious task of investigating each claim. This work was carried out with the utmost care, until the number of contenders was reduced to eighty-three. The final choice was made from this group.

Dr. Langmuir's distinguished service in the cause of science covers a period of a quarter century. Today, he stands in the forefront of American physicists. In scientific circles the world over, he is famed for his contributions to the knowledge of atomic structure; the theory of the single molecular layer; the heat of atomic hydrogen and its application to electric arc welding; the effects of gases on electrically heated filaments as applied to gas-filled tungsten lamps, and the laws of electron emission as applied to radio and other vacuum tubes.

The fruits of this formidable series of studies and experiments were not permitted to remain in the laboratory, but have been translated into improvements that add to the comfort and pleasure of virtually every man, woman, and child in this country.

Dr. Langmuir's outstanding achievement from the practical point of view is his invention of the nitrogen-filled incandescent electric light bulb. He was the first to apply argon, one of the rare gases of the atmosphere, and nitrogen to tungsten lamps. This improvement has reduced by fifty percent the cost of more than half the electric current bought in the United States for lighting purposes. In terms of actual *(Continued on page 122)*

Dr. IRVING LANGMUIR

Gold medal, obverse at left and reverse above, presented to Dr. Langmuir in commemoration of his selection for Popular Science Monthly's $10,000 Annual Award

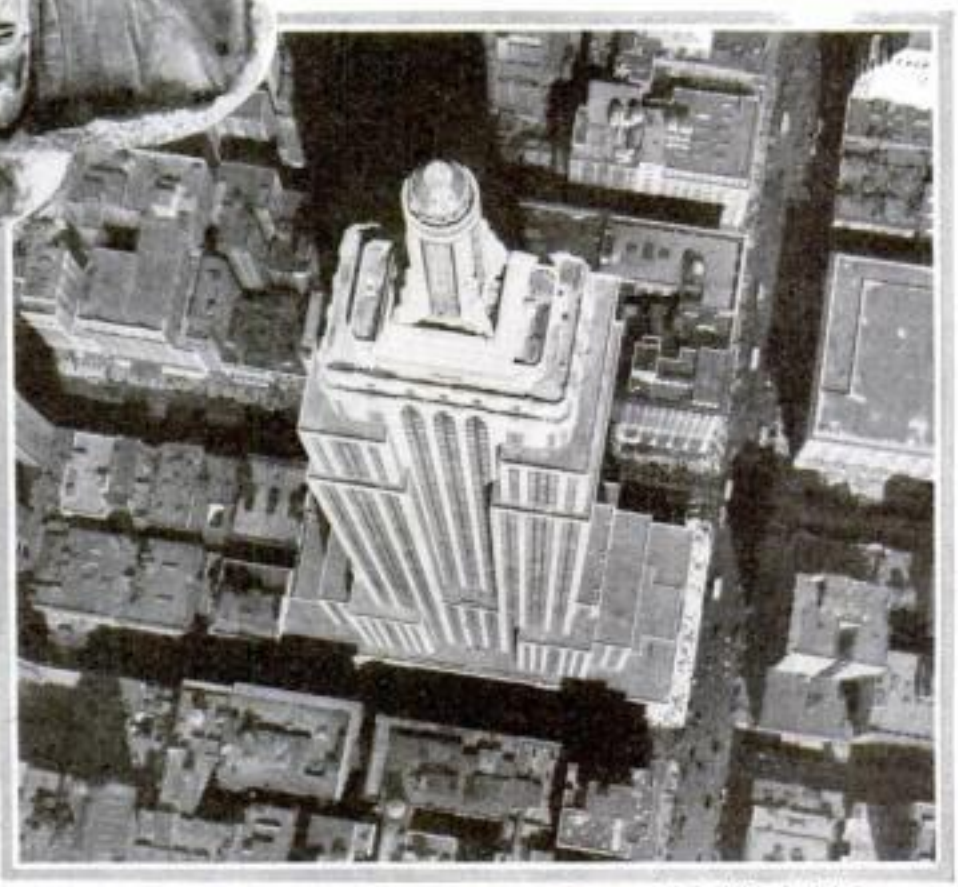
CONSPICUOUS in the long list of Dr. Langmuir's work stands the nitrogen-filled electric light bulb, which he invented, the atomic welding arc, and valuable contributions to radio

Seeing the World

An Article *by One of the Best of All Aviators. He was Lindbergh's Partner in Barnstorming and Is Famous as a Stunt Man, Air Mail Flyer, Teacher, Radio Operator, and Photographic Pilot*

By
RANDY ENSLOW

Wearing a fur-lined flying suit and face mask, this photographer, with his camera, is ready for high altitude work. Pictures are taken through a special door built into the side of the fuselage of the photographic planes



Even the towering Empire State Building is dwarfed when it is caught by a camera from a speeding plane. The picture at the right shows the mammoth structure photographed at an unusual angle as Enslow flew high over New York streets

Courtesy Fairchild Aerial Surveys

WE WERE waiting for the *Winnie Mae,* 2,000 feet above Jamaica, Long Island. All day, the telegraph at Roosevelt Field had been clicking out the progress of Post and Gatty as they raced down the home stretch in their eight-day circle of the globe. About six o'clock came word that they were over New Jersey. A news photographer and I scrambled into a Fairchild monoplane, the big engine roared, and we were off to get an air shot of the Lockheed as it crossed the finish line.

While we circled near Jamaica, the towers of New York, sixteen miles away, disappeared in the twilight. To get a picture, we would have to be close to the white Lockheed, which I knew would be flying fifty miles an hour faster than our top speed. So, while we waited, I climbed for altitude.

Then a speck in the gray sky grew larger. It was the *Winnie Mae.* It come tearing out of the west, streaking for Roosevelt Field, clipping seconds from the round-the-world record at every mile. They were flying low, the nose of their Lockheed down and its Wasp engine wide open.

I swung toward the field at full gun, a thousand feet higher in the air. When they were a quarter of a mile behind, and coming like a streamlined bullet, I shoved ahead the stick into a power dive. We streaked down out of the sky like a pursuit ship, leveled off beside the rocketing *Winnie Mae,* our momentum carrying us for a few seconds at almost equal speed. Then the white ship pulled away from us like the Cannon Ball Express leaving a freight train behind. But, during those few seconds, the camera man had snapped his picture.

Such maneuvers are all part of the day's work in piloting planes for the flying cameras. During the past ten years, I have flown in every kind of photographic work that takes place in the sky. I have carried photographers for all the New York newspapers, newsreel men for most of the movie concerns, and have flown maps covering hundreds of square miles for the Fairchild Aerial Surveys.

I have piloted camera men over the Everglades in Florida, into the gorge at Niagara Falls, above the skyscrapers of New York, and out to sea to meet incoming liners. I have flown above a flaming prison in the middle of the night, during a riot, and have made aerial maps in the thin air at 19,000 feet.

The most thrilling thirty seconds of all occurred during my first flight with a movie camera. After barnstorming east, as a "gypsy pilot," from St. Louis in my old Standard biplane, I landed at Rochester, N. Y. A local theater wanted to make a film of a flight between Rochester and Buffalo, with a shot of Niagara Falls as the climax. With the camera man cranking away in the front cockpit, I hopped off.

The day was perfect for flying. In fact, you don't get bad weather in camera flying. You have to have good weather to get good pictures. There wasn't even a bump all the way to Buffalo. We sailed above the factory chimneys, with their black streamers of smoke, and headed for the Falls.

Then the photographer had a bright idea. He motioned for me to dive under the suspension bridge so he could get a picture down in the gorge. From our altitude, the foaming torrent at the bottom of this deep gash in the earth looked like a narrow white ribbon. I nosed down with the throttle open. We were going 140 miles an hour when the walls of the canyon flashed up on either side and the narrow steel bridge rushed back over our heads.

THE photographer was so excited he forgot to grind his camera and hung on for dear life. We were less than 180 feet from the seething, spray-filled bottom of the gorge when I pulled up the nose of the ship at the end of the dive. Then, the real excitement began!

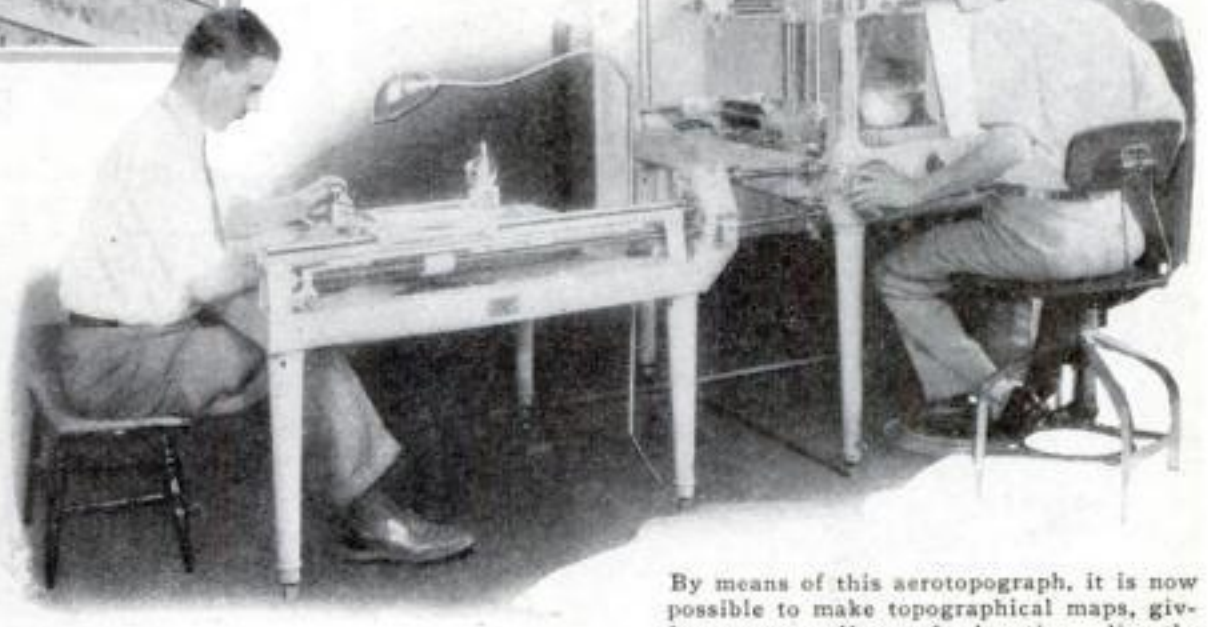
The wings, caught in a violent downdraft, mushed through the air. Although the nose was tilted up and the engine roaring at full throttle, the ship "floated" for what seemed miles before it tore free from the grip of the down-currents and lifted itself slowly above the rim of the rocky walls. It was then that the camera man discovered he had forgotten to crank

with a FLYING CAMERA

Randy Enslow in cockpit with camera man, ready to start his first picture-making flight which led to thrilling moments in the gorge at Niagara Falls

Enslow examines the pitot tube of his air speed indicator before starting on a flight

How Statue of Liberty looked to the camera from an elevation of 1,500 feet when seen at night by the aid of a three-billion-candle-power flashlight bomb



By means of this aerotopograph, it is now possible to make topographical maps, giving contour lines of elevation, directly from pictures taken in the air. Operator at right traces in hills and valleys, which are recorded on paper on table at left as second operator puts in roads and houses

and wanted to go back again! But my thumbs were down; I had seen all I wanted of *that* gorge. So we went for a joy ride over the Falls, instead. Every time we crossed above the brink, the ship dropped straight down for a dozen feet. The plunge of the torrent was sucking air down into the gorge.

In 1926, I made a movie of what a pilot sees in a tail spin. Fifteen hundred feet above Roosevelt Field, I pulled a string that started the camera working and then stalled the ship into a spin. We came down to 400 feet, spinning like a top, while the camera caught the earth streaking around in a dizzying whirl.

Once, I flew a camera man 15,000 feet over New York City to make shots for a picture called *Three Miles Up*, and another time sailed close beside a plane that flipped over on its back and let a parachute jumper fall out of the forward cockpit for a newsreel stunt.

Of all kinds of photographic flying, probably the most difficult is air mapping, but it is also the best paid. A pilot gets about nine dollars base pay while on such a job and extra for flying time, bringing the total to as much as $25 a day.

The piloting is all done at high altitudes, between 15,000 and 20,000 feet. There are two reasons for this. In the first place, it permits the cameras to catch a greater area at each exposure, and in the second, the air at higher levels has no bumps. This is important, because a mapping camera points straight down through a special hole in the bottom of the fuselage, and if a plane were pitching in gusts or rocked by bumps, the lens would be tilted at different angles in relation to the earth and accurate work would be impossible. By means of two bubbles, like those in spirit levels, on the suspension cradle which holds the camera, the photographer determines if his instrument is perfectly level each time he snaps the shutter.

The operators call air mapping cameras "clickers." Each "clicker" carries a ninety-foot roll of film. The lenses in the instruments vary from five to twenty-four inches in diameter, and the cost of the cameras from $500 to $2,000. The latest type, just developed for the United States Army, has five lenses, takes five pictures at once, and carries two rolls of film. On the resulting combination picture, shaped like a Maltese cross, it records a huge area of ground. Recently, in Maine, 3,600 square miles of territory were mapped in three hours by this "Big Bertha" in the hands of Capt. A. W. Stevens, famous Air Corps photographer.

Last May, Stevens and his pilot, Lieut. J. D. Corkville, had a thrilling experience with a blown-out oxygen tank 25,000 feet above New York City. While they were taking pictures, a gasket on the pilot's tank blew away, cutting off his supply of gas. By passing the tube of Stevens' container back and forth, each taking a puff or two, the men stayed aloft until they had snapped *(Continued on page 115)*

ARMS TO FLAP BATLIKE WINGS OF MAN-POWERED AIRPLANE

THOUGH aviation's annals hold no record that any man ever succeeded in making a sustained flight with a machine propelled by his own muscular exertion, a New London, Conn., inventor plans soon to make the try. He has constructed a pair of wings of twenty-two-foot spread, mounted in a framework so that they may be flapped by his arms. His legs, he says, will operate the craft's tail. In the air, the flyer's body would be horizontal. The apparatus weighs forty pounds.

ENGINES IN BRAZIL USE COFFEE AS FUEL

Brazil's surplus coffee is used as fuel to run the locomotives

FIREMEN on Brazilian railroads now hurl shovelfuls of coffee beans, instead of coal, into locomotive fire boxes. Because of an enormous surplus production, coffee has become so plentiful in this country that inferior grades are being used as fuel. Hence the strange sight of a locomotive tender heaped with tons of the brown beans.

As was previously reported in this magazine, one Brazilian town has also employed coffee beans in the manufacture of gas for household consumption (P. S. M., Mar. '32, p. 47).

ROTARY TOOTHBRUSH RUN BY WATER POWER

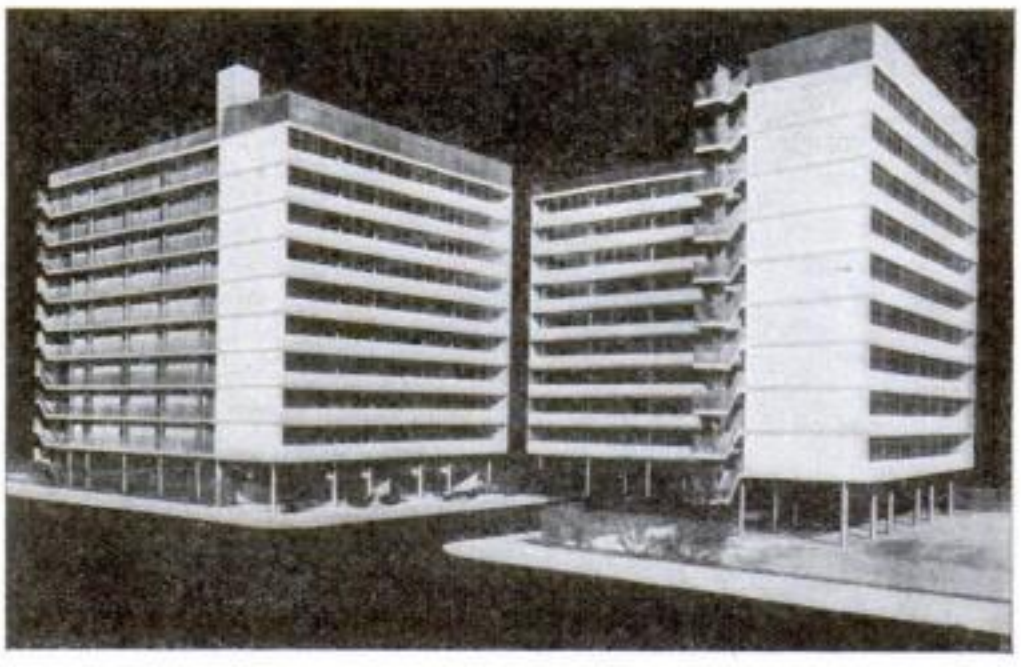
WATER power runs a labor-saving toothbrush recently exhibited in England. A miniature water wheel attached to the bathroom faucet spins the brush. A switch on the handle controls the speed of the brush, which receives its rotary motion through a flexible cable.

FLY-SWATTER GETS INSECTS IN FLIGHT

NO LONGER immune from execution are houseflies buzzing through the air, since the invention of a double-action fly-swatter with two surfaces that snap together. By nipping flies in flight, it avoids staining walls or furnishings.

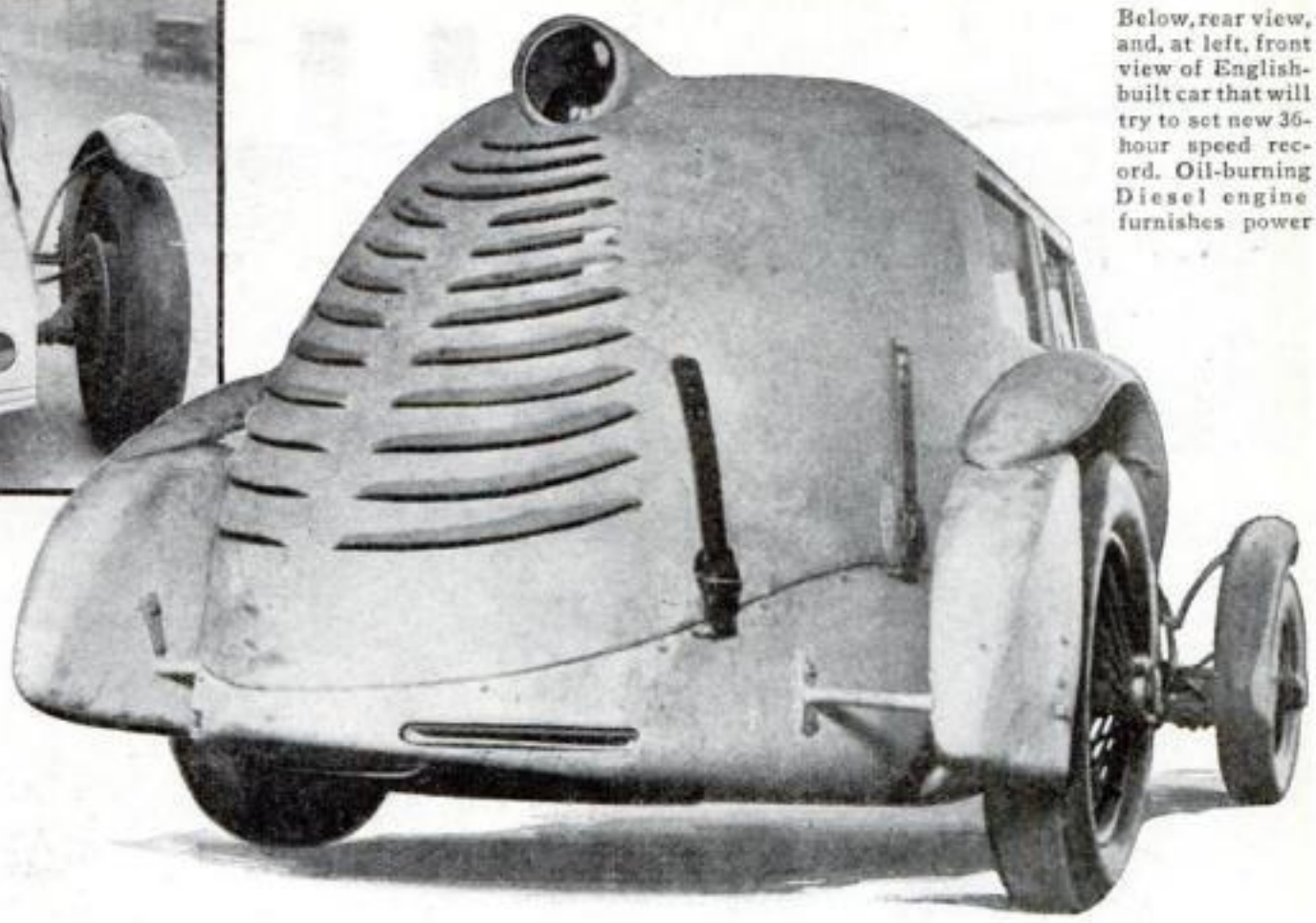
NEW APARTMENT HOUSES TO STAND ON STILTS

NINE-STORY apartment homes on stilts are proposed for New York City. Models of the dwellings were exhibited the other day by William Descaze and George Howe, the two architects who worked out the novel plan. The structures would have no first stories. Almost all the space usually devoted to a ground floor is reserved as a sheltered playground for children. According to the architects, apartments on the street level will never be missed. The proposed apartments are to have a glass-and-metal exterior, with long ribbon-like windows, seen in the illustration.



Architect plans metal and glass apartment houses that will stand on stilts

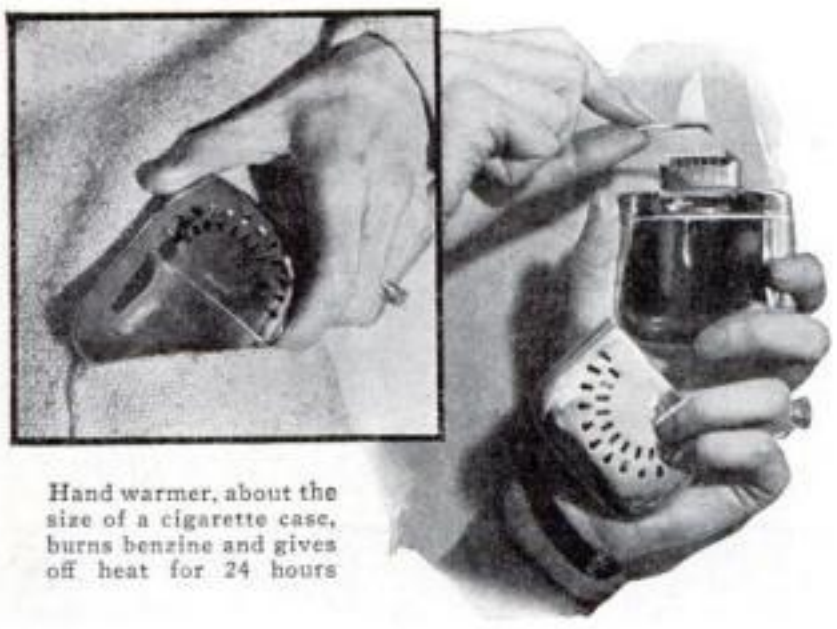
MYSTERY CAR SEEKS SPEED RECORD



Below, rear view, and, at left, front view of English-built car that will try to set new 36-hour speed record. Oil-burning Diesel engine furnishes power

A STRANGE "mechanical beetle" has just been completed at Maida Vale, England, for an attempt to break the world's thirty-six-hour nonstop speed record for automobiles. Efforts to reduce wind resistance are responsible for its unusual lines. Instead of projecting, the headlamps, arranged one above another, are sunk within the front of the body, as shown in the picture at upper left, and protected by a grid. A porthole-shaped rear window has a glass lens that gives the driver a wide-angle view of the road behind him. Oil instead of gasoline will be used for fuel, and the unusual auto will be powered by a Diesel engine of experimental design. Kaye Don, British sportsman who took part in speedboat races in this country last year, may drive the car in the record attempt.

NEW HAND WARMER FITS POCKET

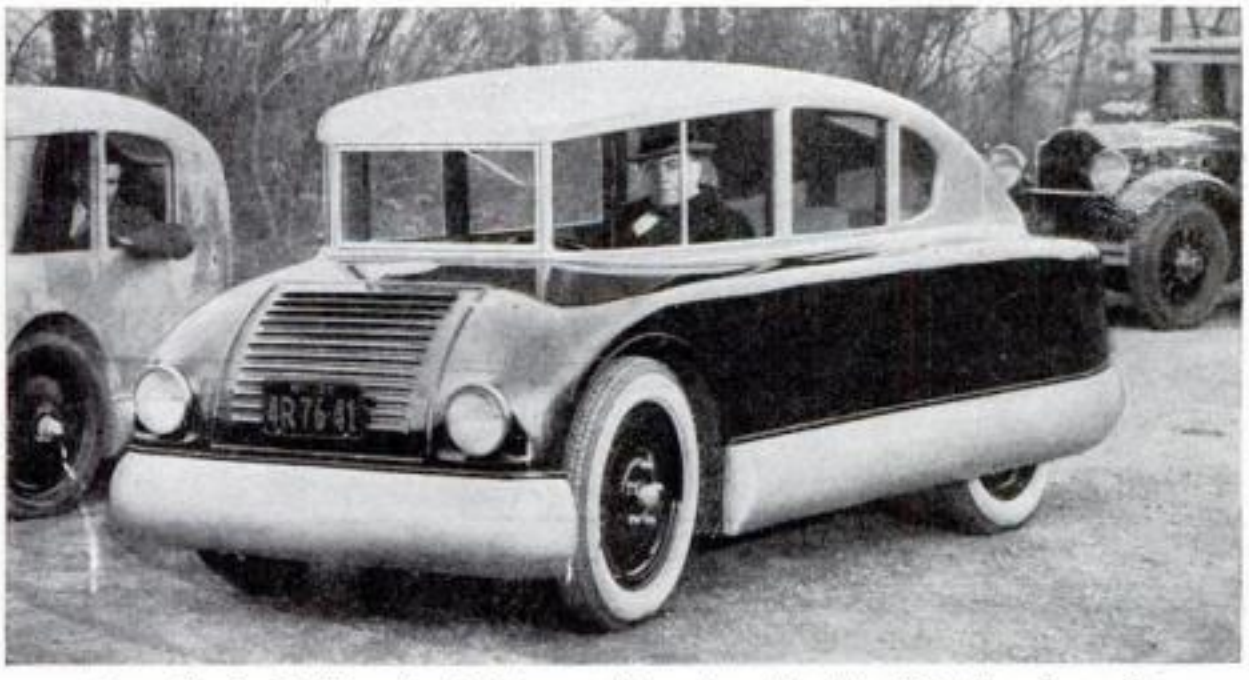


Hand warmer, about the size of a cigarette case, burns benzine and gives off heat for 24 hours

FIRST aid to chilly hands is a pocket-sized warmer, just placed on the market. Handy for those who work or play outdoors in cold weather, the device is about the size of a cigarette case. Cigarette lighter fuel or ordinary benzine furnishes the heat. When it is filled and the asbestos wick lit, the hand warmer will glow with a mild heat for twenty-four hours. According to the maker, it may be carried in a pocket while lighted. In the home the device may be used to replace the old-fashioned hot-water bottle.

SELF-LIGHTING RAZOR

EARLY-morning risers may praise the inventor of a new razor that carries its own light for shaving. Since the tiny lamp's beam is focused directly upon the path of the blade, no lurking stubble can escape the user's eye. The hollow handle of the razor contains the battery that furnishes the current, while a switch is within convenient reach of the thumb.

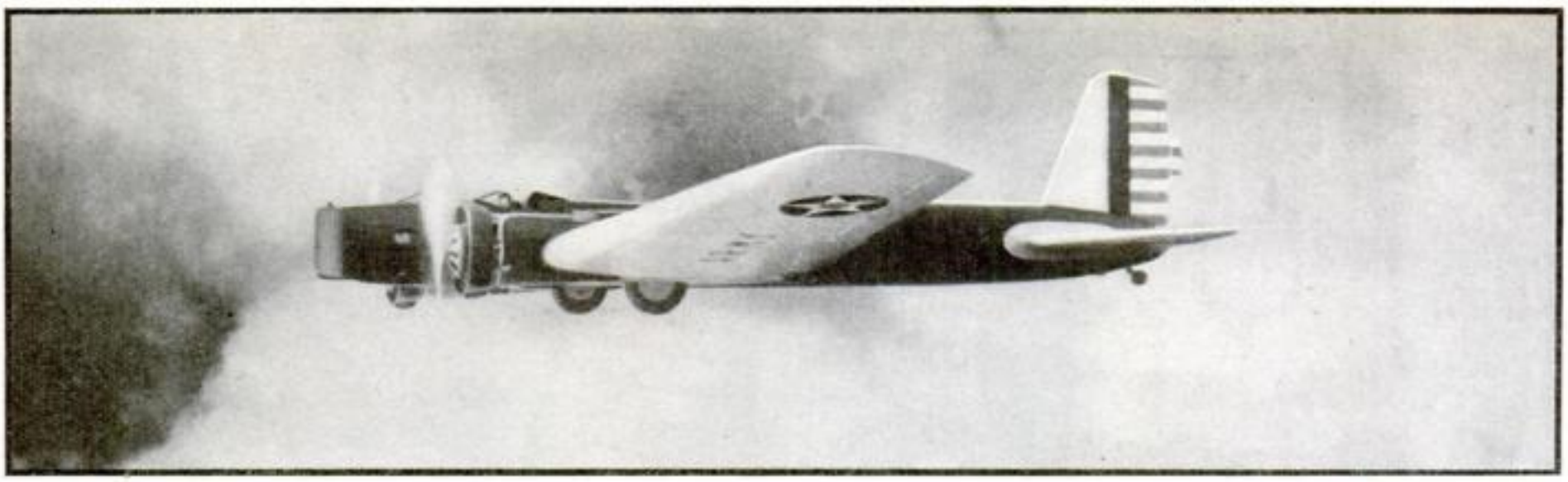


Streamlined and with engine in the rear, this car is said to hit a 110-mile-an-hour clip

FAST STREAMLINED CAR ENCIRCLED BY BUMPER

A NEW motor car, streamlined and declared by its builder to be capable of 110-mile-an-hour speed, recently had its try-out on New York streets. It is the third oddity in automobiles to come from the workshop of Capt. James V. Martin, airplane builder of Garden City, N. Y.

Like a midget car he designed in 1929 and a fast little three-wheeled machine demonstrated a short time ago (P.S.M., Mar. '32, p. 27), the latest model has no chassis, axles, or springs. Its squat shape is emphasized by a resilient bumper completely surrounding it. A compartment at the rear of the car houses the engine. Wheels are mounted independently on specially made shock absorbers composed of elastic "aviation cord."



ARMY'S NEW STREAMLINED BOMBING PLANE PROVES FAST

A VERITABLE "flying wing" is the United States Army Air Corps' latest style of bombing plane. One of the fastest ever built, its clean streamlined form is emphasized by retractable wheels that fold up within the fuselage. Twin engines drive the low-wing monoplane. The craft pictured in flight in the striking photograph above was recently accepted by the Army.

HEATED GLOVES FOR ARMY FLYERS

WARM hands for Army flyers are assured by electrically heated flying gloves. Developed by United States Army Air Corps engineers, they consist of heaters, worn next to the hands, and glove-shaped covers that have heating elements extending from wrist to finger tips.

Above, Army aviator wearing electrically heated gloves, front and back views of which are shown in picture at the right

RUSSIAN AUTOGIRO HAS ROTOR BELOW FUSELAGE

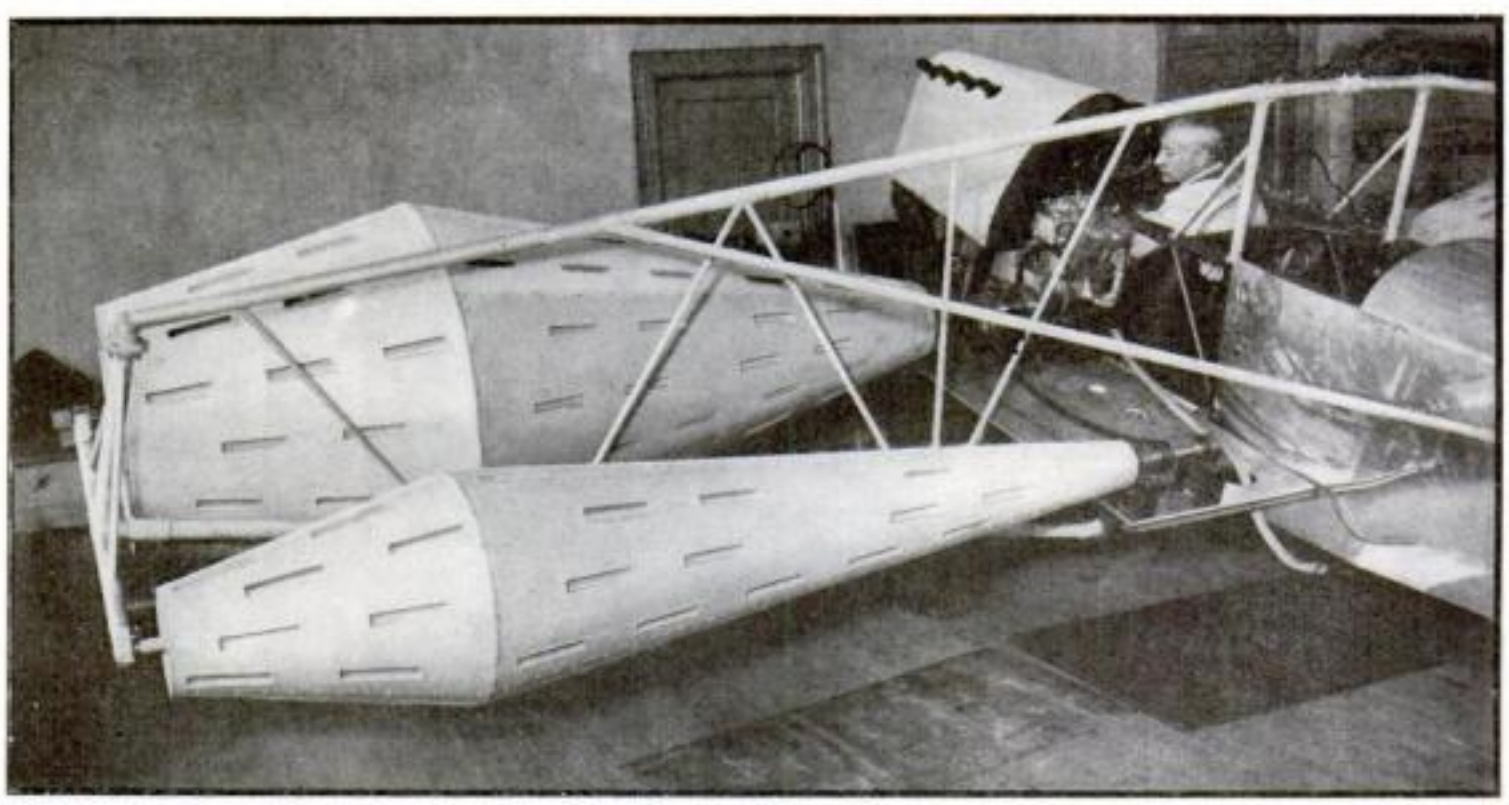
A NEW type of autogiro airplane, intended especially for Arctic exploration, is reported to have been invented in Russia, with the rotor or "windmill" mounted beneath the fuselage. Stubby wing surfaces, found in American models, have been entirely dispensed with, and the rotor alone sustains the machine in flight. It may also be used for taking air photographs, sprinkling insect poison from the air, and many other purposes.

BRITISH WAR TRUCKS CAN DODGE BOMBS

BRITISH military engineers have perfected an automobile truck that can dodge the bombs of enemy airplanes. When a bombardment from the air begins the trucks can leave the road and scatter in every direction. Their endless treads enable them to crawl over rocky country and through swamps.

WHIRLING SPINDLES REPLACE WINGS ON MYSTERY PLANE

WINGS on this privately constructed plane are replaced by spindles, whirled by two small motors. A third engine drives the propeller and furnishes traction. The machine, built behind locked doors in New York City, is the invention of John B. Guest, physicist and inventor of the Pacific coast, and was put together under the direction of I. C. Popper, construction and designing engineer of New York City. The plane weighs 1,429 pounds. It has a span of twenty-three and a half feet and an over-all length of eighteen feet. Tests of this novel aircraft at a New York field are planned.

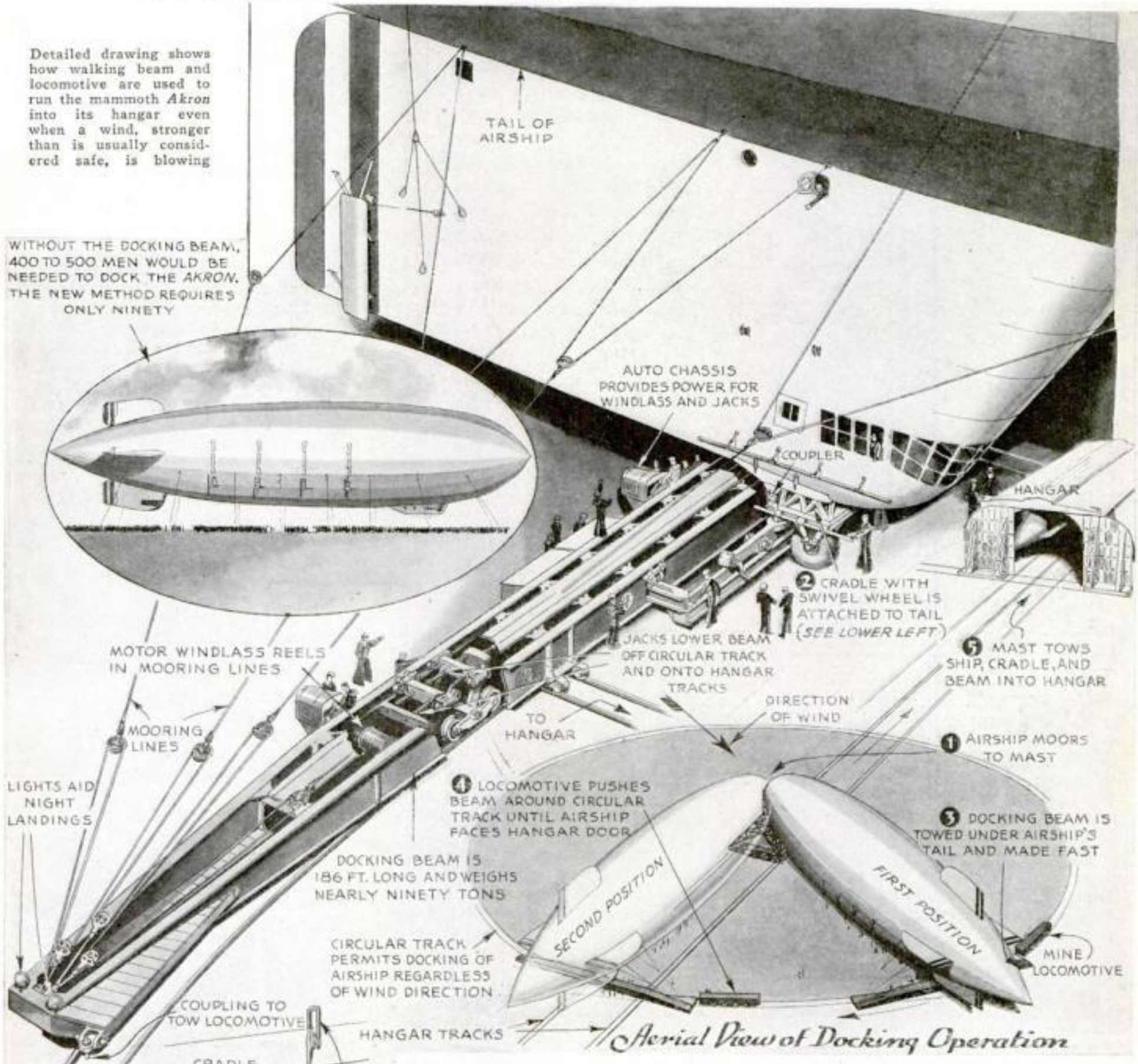


Built in the heart of New York City, this mystery plane has spindles, whirled by small motors, in place of wings. A third motor drives the propeller for traction. Flying tests of the machine are to be made soon

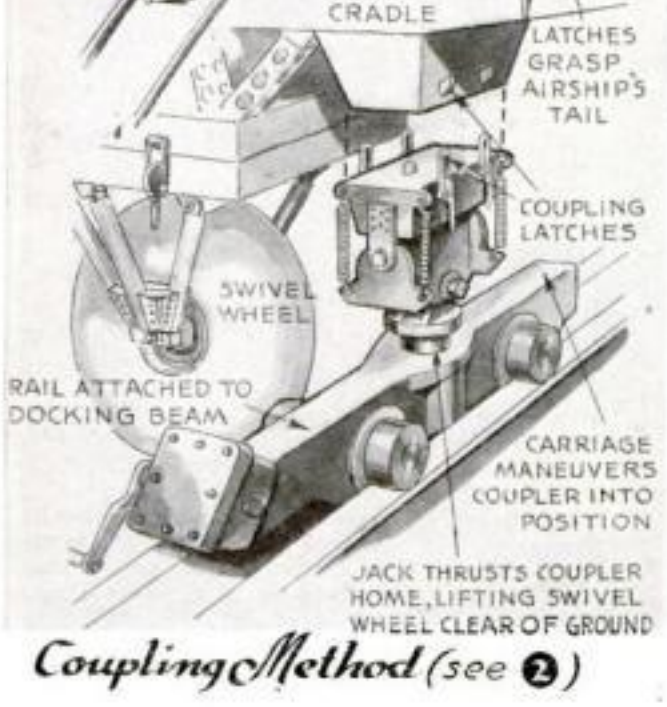
"Walking Beam" *docks Giant Airship*

New Method Stows *Akron* in Hangar in Spite of Twenty-Five-Mile Wind

Detailed drawing shows how walking beam and locomotive are used to run the mammoth *Akron* into its hangar even when a wind, stronger than is usually considered safe, is blowing



Aerial View of Docking Operation



Coupling Method (see 2)

IT TAKES only ninety men now to dock the biggest ship in the world —the giant Navy dirigible *Akron*— in her Lakehurst, N. J., hangar. An innovation in mooring methods practiced there, centering around a massive docking beam invented by Lieut. C. M. Bolster, U. S. N., has aroused the interest of airship experts the world over.

The new method eliminates the gravest danger an airship can face—the risk that a sudden side gust of wind may smash it against the hangar doorway while it is passing through. So securely held is the *Akron* that she cannot break loose even in a twenty-five-mile wind. Hitherto it has been considered unsafe to dock an airship of such size when the wind exceeded eight miles an hour.

Steps in the docking operation are shown above. As soon as the airship's nose is secured to the mast on the field, a low-hung mine locomotive scoots beneath the tail, towing the 186-foot docking beam. With the tail of the ship made fast by mooring lines and a coupler, it may be pushed around against the wind until the ship faces the hangar. Then a second locomotive tows mast and airship inside, the beam acting as a carriage on rollers. To launch the airship, the procedure is reversed. During either process the massive docking beam moves so freely upon its anti-friction rollers that the airship is able to transmit the mast's pushing or pulling force through its own frame without excessive strain, according to naval experts.

Fire *and* Tools *made*

Another Chapter in

Civilization Began a Million Years Ago

NINE hundred thousand years have been added to man's history by a discovery just made in China. Dr. Davidson Black, Canadian scientist, has found evidence that man used fire and tools a million years ago. Hitherto scientists believed the beginning of civilization could be traced back only 100,000 years. At the left is a drawing of Peking man made by Dr. Bohlin of Sweden, one of the discoverers of the bones of this first fire-using man. Dr. Wissler in his talk in this issue explains fully the significance of the find made by Dr. Black.

THE miraculous story of a speck of living jelly that became a man in a thousand million years was told in the early chapters of this series by Dr. William K. Gregory, of the American Museum of Natural History. The mechanism of heredity was explained by Dr. Herbert Ruckes, of the College of the City of New York. In the last two installments, Dr. A. T. Poffenberger, of Columbia University, traced the origin of man's mind and emotions. With the aid of this mind, Man can speak around the world, hear across the ocean, and weigh the stars. He turns night into day, winter into summer, and the desert into a garden. How did all this begin? In this talk, Dr. Clark Wissler, Curator-in-Chief, Department of Anthropology, American Museum of Natural History, and Professor of Anthropology, Yale University, tells Michel Mok, staff writer, how man learned to use tools.

MR. MOK: On my way to your office, Dr. Wissler, I passed the Empire State Building. As I watched it, and the usual busy scene in the streets, I was struck by the tremendous changes that have occurred since the days of our primitive ancestors. How did this world of ours develop into what it is today?

DR. WISSLER: Very slowly. Rome wasn't built in a day; neither was Fifth Avenue. Take, for example, the skyscraper. It grew, by easy stages, through tens of thousands of years, out of the crude hovels of prehistoric times. Even 6,000 years ago, there were skyscrapers.

MR. MOK: That's news to me. I thought we invented them.

DR. WISSLER: Far from it. The ancient Babylonians, about 4,000 B. C., built temple towers to their gods. The Great Pyramid of Gizeh, erected by the Egyptians some 5,500 years ago, is still a marvel of architecture and engineering.

MR. MOK: You wouldn't call that a skyscraper, would you?

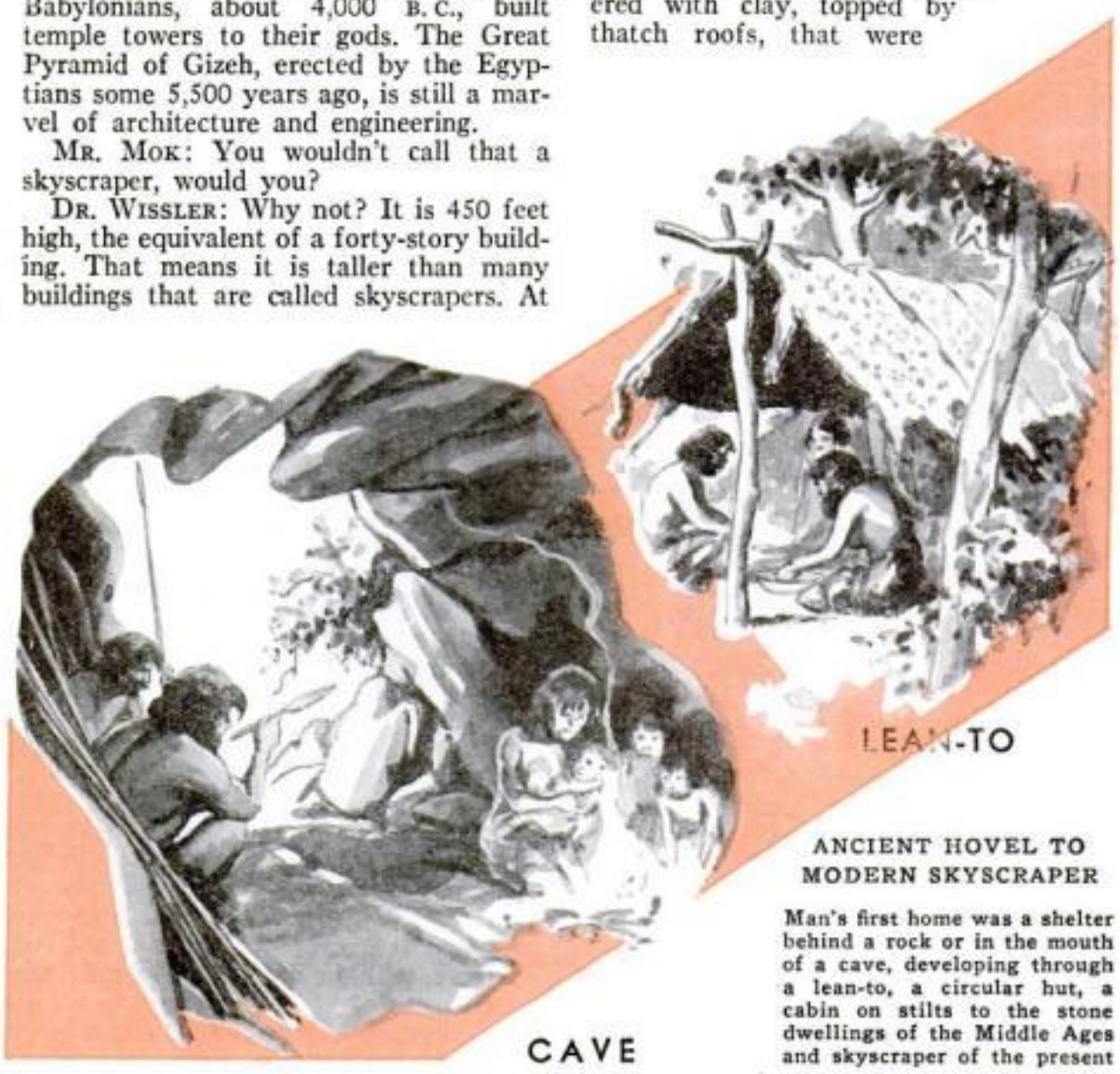
DR. WISSLER: Why not? It is 450 feet high, the equivalent of a forty-story building. That means it is taller than many buildings that are called skyscrapers. At the base, it is 700 feet long, the length of about three city blocks. The way in which the pyramids and the Greek and Roman temples are constructed, shows that we know nothing about stone work that the ancients did not know. The Egyptians and the Greeks joined their stone blocks so perfectly that no cement was needed between them. The Romans, however, used lime-and-sandstone mortar, and they discovered that, by adding volcanic ash, they could mix a water-proof cement. They also invented another important thing in connection with buildings—the mortgage.

MR. MOK: Some people won't thank them for that. The buildings you have mentioned were all temples and monuments. What were the first houses like?

DR. WISSLER: The earliest houses, in our sense of the word, of which remains have been found, were workingmen's cottages on the banks of the Nile, put up to house the laborers who built the pyramids. They were constructed of sun-dried brick which, in our Southwest and in Mexico, is known by its Spanish name, *adobe*. It is noteworthy that this word is derived from the Egyptian *tob*, meaning unburned brick. Those Egyptian bungalows, however, weren't the first dwellings. About 20,000 years ago, New Stone Age men built houses on stilts.

MR. MOK: Why on stilts?

DR. WISSLER: They were huts with walls of plaited twigs covered with clay, topped by thatch roofs, that were

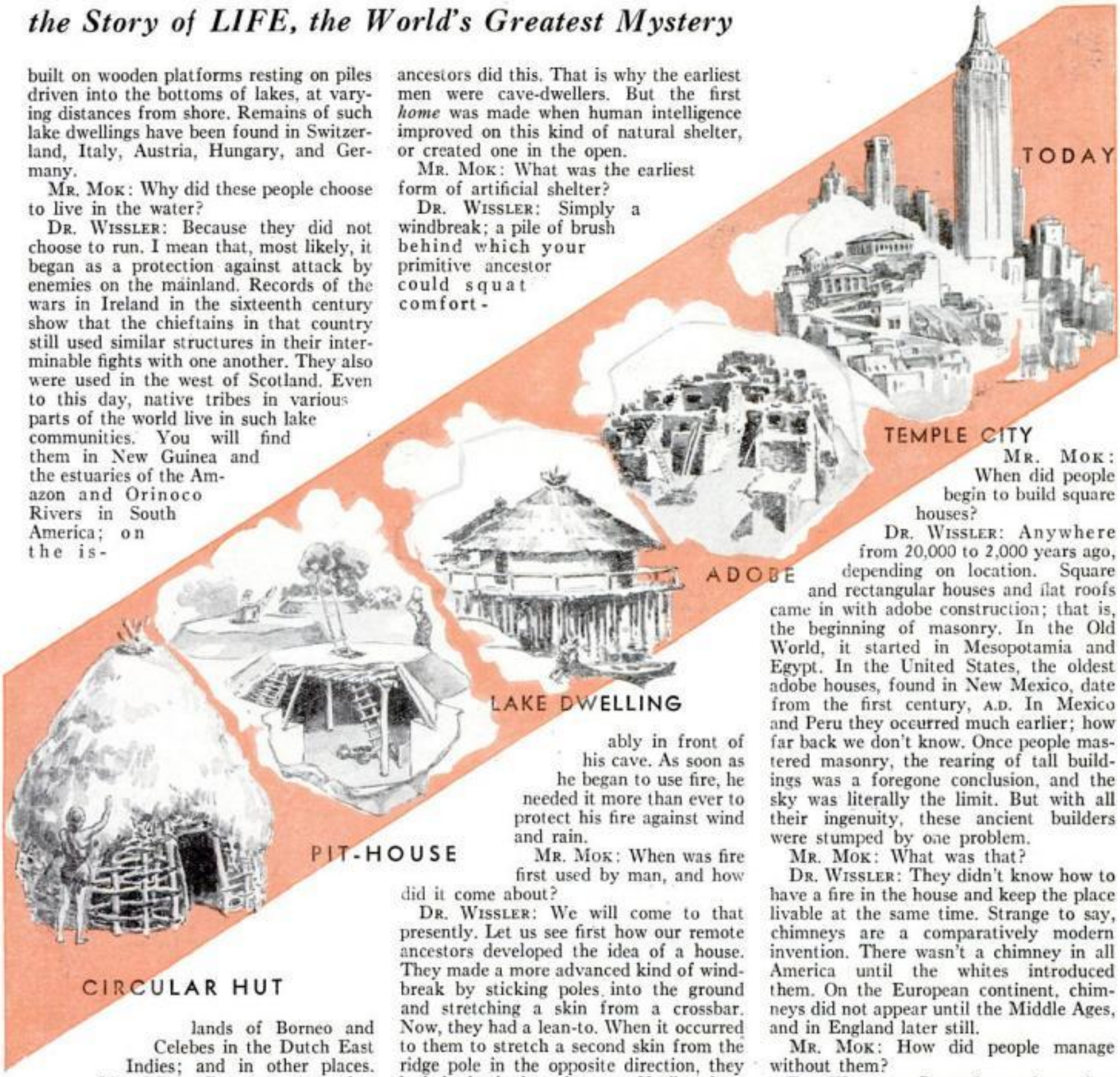


ANCIENT HOVEL TO MODERN SKYSCRAPER

Man's first home was a shelter behind a rock or in the mouth of a cave, developing through a lean-to, a circular hut, a cabin on stilts to the stone dwellings of the Middle Ages and skyscraper of the present

Men-Apes MEN

the Story of LIFE, the World's Greatest Mystery



built on wooden platforms resting on piles driven into the bottoms of lakes, at varying distances from shore. Remains of such lake dwellings have been found in Switzerland, Italy, Austria, Hungary, and Germany.

MR. MOK: Why did these people choose to live in the water?

DR. WISSLER: Because they did not choose to run. I mean that, most likely, it began as a protection against attack by enemies on the mainland. Records of the wars in Ireland in the sixteenth century show that the chieftains in that country still used similar structures in their interminable fights with one another. They also were used in the west of Scotland. Even to this day, native tribes in various parts of the world live in such lake communities. You will find them in New Guinea and the estuaries of the Amazon and Orinoco Rivers in South America; on the islands of Borneo and Celebes in the Dutch East Indies; and in other places.

MR. MOK: Do you mean that these old lake dwellings were the first homes people ever had?

DR. WISSLER: Oh, no. When you enter a room where a number of people are gathered, where do you like to sit?

MR. MOK: I always like to sit against the wall.

DR. WISSLER: Most of us prefer to be seated that way. It is instinctive; a survival of the days when we constantly had to be on guard against enemies and make sure that we could not be attacked from the rear. Animals have the same instinct. In order to have their backs against a wall, and also as a protection against the elements, primitive men sought shelter at the sides of rocks or in the mouths of shallow caves. No doubt, our apelike ancestors did this. That is why the earliest men were cave-dwellers. But the first *home* was made when human intelligence improved on this kind of natural shelter, or created one in the open.

MR. MOK: What was the earliest form of artificial shelter?

DR. WISSLER: Simply a windbreak; a pile of brush behind which your primitive ancestor could squat comfortably in front of his cave. As soon as he began to use fire, he needed it more than ever to protect his fire against wind and rain.

MR. MOK: When was fire first used by man, and how did it come about?

DR. WISSLER: We will come to that presently. Let us see first how our remote ancestors developed the idea of a house. They made a more advanced kind of windbreak by sticking poles into the ground and stretching a skin from a crossbar. Now, they had a lean-to. When it occurred to them to stretch a second skin from the ridge pole in the opposite direction, they had the beginning of a tent. Until a short time ago, Australian natives still made windbreaks of brush, reinforced with tanned skins. Our forebears doubtless did the same thing. The next step was to build such a windbreak all around and interlace the brush overhead. In that way, they got a conical hut. But this is not a comfortable home. You have to stoop to enter it, and inside it is low and cramped. So, to make more room, they dug out the earth inside, and developed the so-called pit-house. Later they had a much brighter idea. They raised the whole affair on poles, and what had been the hut now became the roof. All that was left to be done was to fill in the openings between the poles with plaited twigs, bark, and mud, and they had a circular dwelling.

MR. MOK: When did people begin to build square houses?

DR. WISSLER: Anywhere from 20,000 to 2,000 years ago, depending on location. Square and rectangular houses and flat roofs came in with adobe construction; that is, the beginning of masonry. In the Old World, it started in Mesopotamia and Egypt. In the United States, the oldest adobe houses, found in New Mexico, date from the first century, A.D. In Mexico and Peru they occurred much earlier; how far back we don't know. Once people mastered masonry, the rearing of tall buildings was a foregone conclusion, and the sky was literally the limit. But with all their ingenuity, these ancient builders were stumped by one problem.

MR. MOK: What was that?

DR. WISSLER: They didn't know how to have a fire in the house and keep the place livable at the same time. Strange to say, chimneys are a comparatively modern invention. There wasn't a chimney in all America until the whites introduced them. On the European continent, chimneys did not appear until the Middle Ages, and in England later still.

MR. MOK: How did people manage without them?

DR. WISSLER: In regions where they had adobe houses, the climate usually was mild; fires were used more for cooking than for heating, and they were kept outside. When the fire was indoors, the smoke simply went out through a hole in the roof; or rather, what was left of it after the inhabitants had swallowed a considerable portion. That crude system prevailed in the farmhouses of England as recently as a couple of hundred years ago.

MR. MOK: How old is the use of fire?

DR. WISSLER: If you had asked me that question a month or two ago, I would have had to tell you that I did not know. But now we know definitely that it dates back to the time of the Peking Man; that is, probably about a million years. In other words, it is, apparently, as old as man.

HE WORKED FOR HIS FIRE

Primitive man, probably, first learned of fire from burning forests or grass ignited by lightning. When he began using it, his only means of getting a flame was friction and he whirled a pointed stick in the hollow of a soft log and coaxed the embers into a blaze

Mr. Mok: How do you know that?

Dr. Wissler: As Dr. Gregory has told you, Dr. Davidson Black, professor of anatomy in Peking Union Medical College, aided by his students, has unearthed, within the last two years, two ancient skulls, supposedly those of a man and a woman, in a cave in China. Collectively, they are known as the Peking Man. Though the skulls are thick and the jaws apelike, scientists agree that they are unmistakably human and represent a stage above the Java Man and the Piltdown Man. They were, therefore, among the earliest human beings.

Mr. Mok: I remember Dr. Gregory called them "the Chinese Adam and Eve" (P. S. M., Oct. '31, p. 136).

Dr. Wissler: An excellent name. Now, recently Dr. Black, in further explorations, discovered the remains of fires—ashes, charcoal, and charred bones—in the cave of that prehistoric couple, proving to his satisfaction that they kept the home fires burning.

Mr. Mok: A wise thing to do, seeing they lived in the Ice Age!

Dr. Wissler: Yes, it was a wise thing, or rather an *intelligent* thing, and that shows, even more clearly than the shape of their skulls and teeth, that they were human. This is borne out further by another, equally important, find of Dr. Black's. In the cave, together with the remains of this million-year-old fire, he came upon a number of rude stone tools. The importance of these discoveries cannot be overestimated. They indicate that man started his slow, laborious trudge up the road of civilization hundreds of thousands of years earlier than we had believed he did. In addition, they throw a brilliant new light on the origin of man and his descent from humbler ancestors. To return to the story of fire: I said your Chinese Adam and Eve kept the home fires burning, and I meant that literally, because it is likely that they did not know how to make a fire. Man probably began by guarding and using the fire he found in nature.

Mr. Mok: Who discovered fire?

Dr. Wissler: Who discovered trees, mountains, rivers? It did not need to be discovered. Fire, of course, is much older than man, and from the first he must have seen it in forest fires, in volcanoes, in lightning striking dry grass. No doubt, it began by frightening him out of his wits, but he soon understood its uses and got the idea of carrying it from place to place and keeping it alive. He made a real discovery when he found that he could produce it by friction.

Mr. Mok: How did he discover that?

Dr. Wissler: By observing what happened when he cut or sawed through logs of wood with his stone tools. To get a clear understanding of how things developed in this world, you must realize one important fact. It is this: Primitive people, contrary to what many of us think, are by no means stupid. They are, of course, ignorant of a great many things we know, but they have intelligence, and so had our early ancestors. If this were not so, you and I would not be sitting here now, discussing them. The obstacles they overcome and the dangers they braved were tremendous, and the way in which they solved a number of ticklish problems shows that they were smart and skillful. Take, for instance, this apparently simple matter of making fire by friction. Can you do it?

Mr. Mok: No, I cannot.

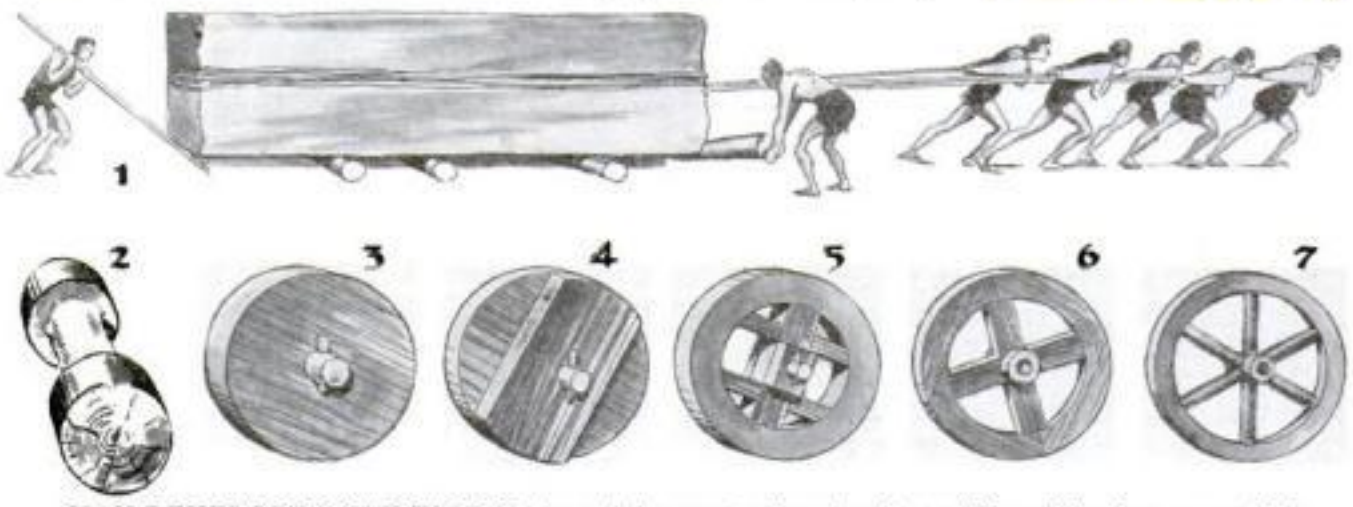
Dr. Wissler: Most people are in the same boat. I used to do it, but it is not easy. Our trouble is that we have no technique; there are no old hands to show us how. Besides, we haven't the incentive of primitive man. He *had* to do it. This is how it is done: You drill a notch or hole in a piece of moderately soft and grainy wood such as white cedar or poplar, with a sharp stone. In this notch you twirl, between your hands, a stick of harder wood, pressing down while you are twirling. The heat developed by the friction helps the stick cut the wood, and a fine dust, like sawdust, is produced. After a while, the underside of the little dust pile ignites and begins to glow. Now you have produced fire, but it won't do you any good unless you know how to handle it. The secret is that the dust preserves the heat, and that the glow dies out if you blow it away. From that point on, the trick is the same as starting a fire from a live cigarette butt. Take some easily inflammable material, like dry grass or leaves, and careful blowing will do the rest. This is the primitive fire drill, and the Australian Bushmen still use it. The Polynesian method is different; in the South Sea Islands they push a pointed stick along a groove of its own making in the underpiece of wood.

Mr. Mok: What was the next step?

Dr. Wissler: A thong, or cord, was attached to the stick and wound around it a few times, and this was pulled to and fro to make the stick twirl. That was perhaps the first labor saving device ever invented. However, the prehistoric men of Europe already knew how to strike sparks with bits of flint from iron pyrites, or pieces of ore, for crude fire making apparatus of this kind has been found in their caves. This method developed much later into the tinder box with its flint and steel, and it survives in our modern cigarette lighter. The ancient Greeks had burning glasses and concave mirrors. The first matches were not invented until 1828; they had heads made of inflammable materials, phosphorus among them. Later, in the safety match, the particles of phosphorus were put on the rubber of the box.

Mr. Mok: You said the fire drill with a thong attached was perhaps the first labor saving device. How about other labor saving devices, such as the lever, the wheel, the pulley? Surely, the ancient builders who put up the magnificent temples and monuments you told me about could not have done all that with their bare hands?

Dr. Wissler: Of course not. From the first, man rebelled against earning his bread by the sweat of his brow, and preferred to do it by the ingenuity of his brain. It is true that necessity is the mother of invention; but laziness is its father. The lever is as old as mankind. Primitive men must have known the inclined plane, or *(Continued on page 117)*



MAN DEVELOPED THE WHEEL through long centuries of patient toiling with a log upon which his heaviest burdens could be slowly rolled along. Doubtless it was from a whole log that he cut his first wheel and axle all in one piece. In time he fashioned a solid wheel as a separate piece and then, to lighten it, he cut spokes the number of which increased until the modern wheel had arrived

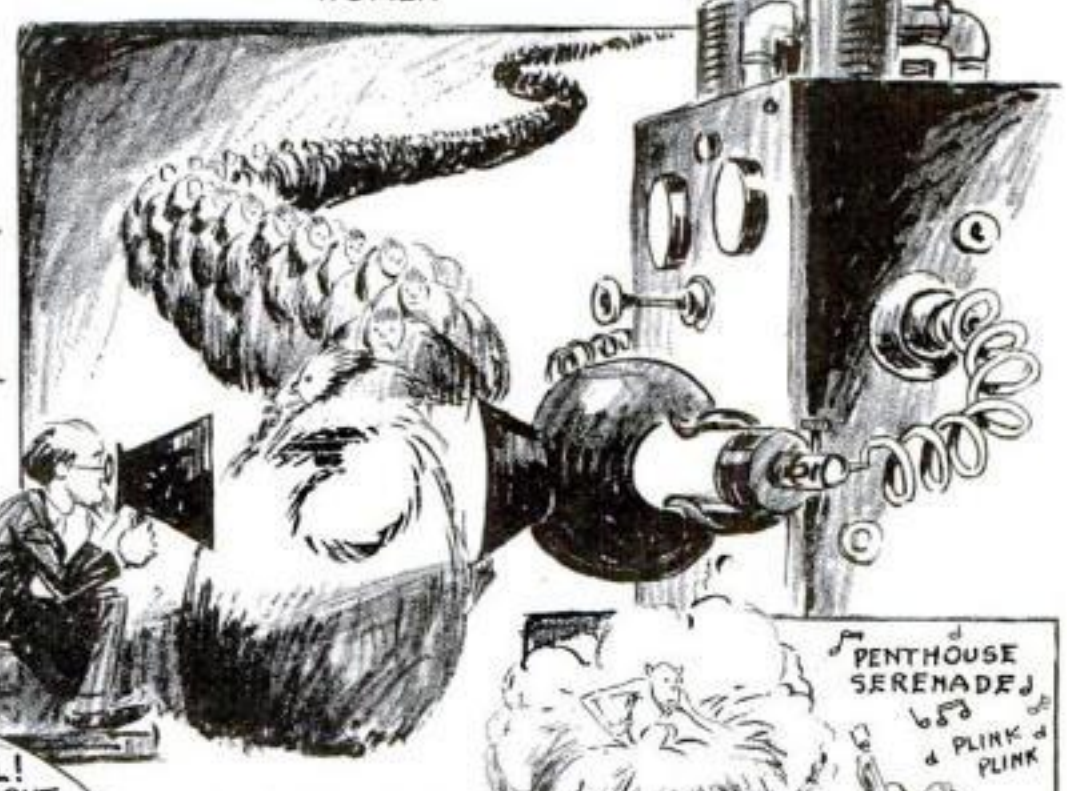
SCIENTIFICKS

. . . OUR ARTIST VIEWS THE STRANGE AND UNUSUAL FACTS DISCLOSED BY LEADING AUTHORITIES IN THE LAST MONTH

FOUR YEARS OF COLLEGE GIVE THE AVERAGE GIRL A SLIM FIGURE, REPORTS HELENA M. KEES, PHYSICAL DIRECTOR, N.J. COLLEGE FOR WOMEN

BANISH THE ALARM CLOCK! SHAKING THE BED IS A MUCH LESS HARMFUL WAY OF AWAKENING A SLEEPER, GERMAN SCIENTISTS HAVE DECIDED

JOBS IN THE FUTURE WILL REQUIRE ONLY 2-3 HOURS A DAY, LEAVING PLENTY OF TIME TO "REST AT HOME, PREDICTS PROF. CLIFFORD C. FURNES, SHEFFIELD SCIENTIFIC SCHOOL



PICKING CHEER LEADERS OR GLEE CLUB SINGERS? AN EASTERN UNIVERSITY IS X-RAYING THE LUNGS OF ALL FRESHMEN

A PENTHOUSE APARTMENT FOR APES HAS BEEN BUILT AT THE YALE UNIVERSITY SCHOOL OF MEDICINE

REPORT ON OCCURRENCE OF PERFECT TEETH OFFERED BY DR. MORRIS STEGGERDA, OF CARNEGIE INSTITUTION:

YUCATAN INDIANS----62%
AMERICAN COLLEGE GIRLS--1%

GETTIN' SO EVEN A DROP OF WATER AIN'T SAFE NO MORE!

DR. A.E. PARR, OCEANOGRAPHER, IS STUDYING OCEAN CURRENTS BY FOLLOWING A DROP OF WATER THROUGH THE GULF OF MEXICO

Why go to Africa? This hunting expedition on the trail of hippopotami took place in the jungles of Sherwood Forest, California

Big Animals *Shot for Movies in California* "JUNGLE"

WILD LIFE IN THE FAR WEST. The comfortably reclining elephant is playing dead and the other is supposed to be heartbroken. The skeletons are plaster. The scene was shot in a Hollywood studio. Upper right, two hippos yawning before the camera

IN A small forest, an hour's drive north of Hollywood, Calif., twenty elephants and seven hippopotami recently were directed in thrilling jungle scenes for a talkie.

Elephants dropped into deep pits and stampeded through the forest to destroy a pygmy village, following the commands of a director who guided them before a battery of talkie cameras which recorded their wild flight.

The animals were selected from circus herds and, contrary to circus practice, they were required to "go native" and behave as though they were in their favorite forest haunts. For five days the elephant stampede was rehearsed, and when finally cameras began to grind, the thoroughly excited elephants ran 300 feet in front of ten cameras. At the end of the

With talkie cameras whirring near at hand, two apes put on a realistic African fight only an hour's drive from Hollywood

At right, Director W. S. Van Dyke cultivates the friendship of "Emma," a trained chimpanzee, who appears as one of the actors in a sound movie film

Below, this herd of circus elephants, after being rehearsed for five days, went through a jungle stampede, sound and motion of which were recorded for a moving picture

Trained Elephants and Hippos Stage Stampede and Attack Hunters While Talkie Cameras Make Film "Thriller"

run they crashed into a pygmy village of make-believe huts.

All the jungle tricks of elephants are revealed in the picture. One was made to kneel at the end of a deep pit and pull up an actor by the arm. Others drew a trapped elephant from a pit by tugging at a vine-covered cable to the other end of which the rescued pachyderm clung.

The seven hippopotami, six of which had been born in captivity, found their wild instincts returned when they were loosed in the lake. They proved fairly good actors for one scene, fighting back at hunters in the water. One was wanted to open his mouth at a rifleman. This finally was accomplished by beaters with poles who kept the animal in the lake. Enraged, he opened his mouth to roar **just as the cameras whirred.**

At left, one of the elephant actors charging through a tropical forest in California. Above, prodded back into the water by the man with the pole, this hippo became enraged and opened its mouth to roar a protest just as the hunter fired a blank cartridge and the camera shutter snapped

Blackmailers *and* Forgers

By EDWIN W. TEALE

Scientific detective using the spectrophotometer, which analyzes color of paper and ink by distinguishing between wave length of light

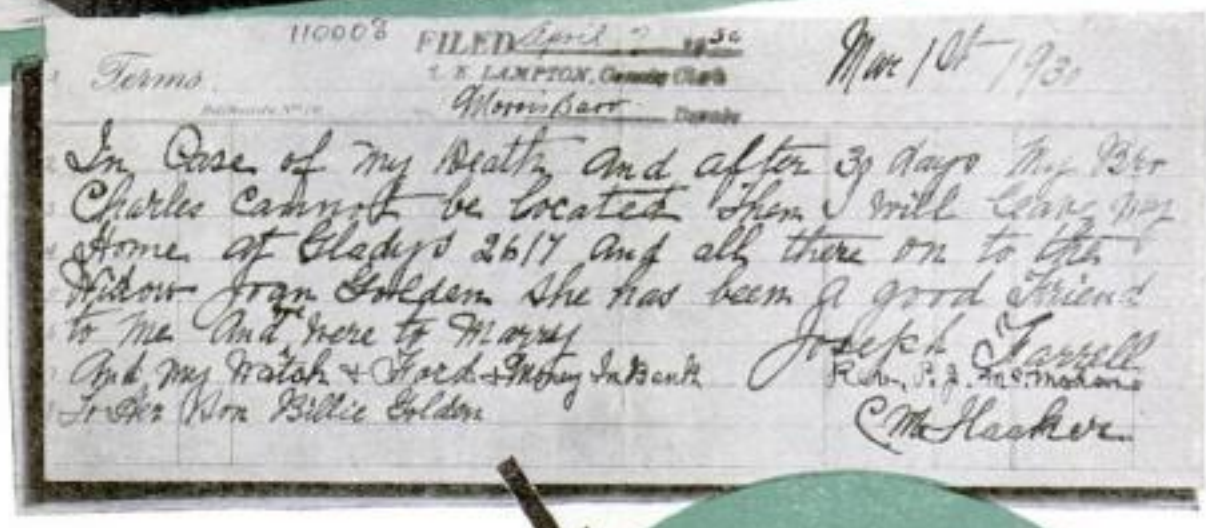
IMAGINE the cross on a "t," one five-hundredths of an inch thicker on one end than on the other, trapping a forger! Or the tail of a single comma exposing an elaborate fraud! Imagine a fake will plot nipped in the bud through the shape of a dot above an "i," a cunning swindle stopped by the loop of an "e"!

Such amazing feats are not taken from the pages of fiction. They are facts. They are on record in the files of scientific criminal hunters with whom I have talked. The story of these handwriting experts and their relentless battle to outwit the crooked penmen is an engrossing tale of applied science waging war against crime. In this battle, success often hangs upon strange and slender threads.

That was the situation in the astonishing "Ghost-Note Case," solved in a southern state not long ago. Six weeks after the death of a wealthy cotton planter, a man from a town forty miles away presented a note for $5,000 to the executors of the estate. He said the planter had "borrowed against his crop" for that amount, going to an individual in another community rather than to his local bank to keep friends from learning of his temporary financial embarrassment.

The executors were puzzled. The signature on the note seemed genuine, but they found no record of the transaction in the papers of the deceased. So they submitted the disputed document to the laboratory of a handwriting detective.

Peering through compound microscopes and measuring the width of lines with delicate precision instruments, this expert set to work. In five minutes, he had bared the note as a clever forgery through evidence contained in a single, fine line of ink, less than three-sixteenths of an inch in length and only a hundredth of an inch in width!



TINY LOOP BEATS FORGER

Above, a bogus will shown to be a forgery by the loop of the letter "p" in "Joseph." This loop is written over "Rev." in witness's signature, proving testator's name was written last. At right, comparison of Farrell's writing with forgery. Genuine is at the right

It was the cross on the "t" in the planter's name. Although made with a fine steel pen, it was shown by the laboratory instruments to be nearly a fifth wider at the end than at the beginning. That five-hundredth of an inch difference would have meant nothing to an ordinary person, but to the expert, it indicated that greater pressure had been applied to the pen at the termination of the stroke than at the start. A microscopic examination of some ninety genuine signatures of the planter showed that he always placed the greatest pressure on the pen at the beginning of the stroke, while in the writing of the man who presented the note, the pressure came invariably at the end!

In crossing a "t," everyone presses down on the pen more at one point than another. Some put the pressure at one end, others at the other, a few in the middle. But however they do it, they always do it the same. It was this slight difference in pressure, of which he was unaware, that tripped up the forger. Confronted with the evidence against him, he confessed that the paper was a "ghost-note," forged after the death of the planter to defraud the heirs.

Upon such unnoticed, subconscious tricks of penmanship, the handwriting expert often depends for clues to a forgery. Even in printed writing, eccentricities frequently lead to detection. J. Fordyce Wood, the Chicago expert who figured in the famous Leopold-Loeb case, told me the printed address on the envelopes

Betrayed *by Their* PENS

Fiction Lags Far Behind Thrilling Work of Modern Scientific Sleuth In Solving Mysterious Crimes

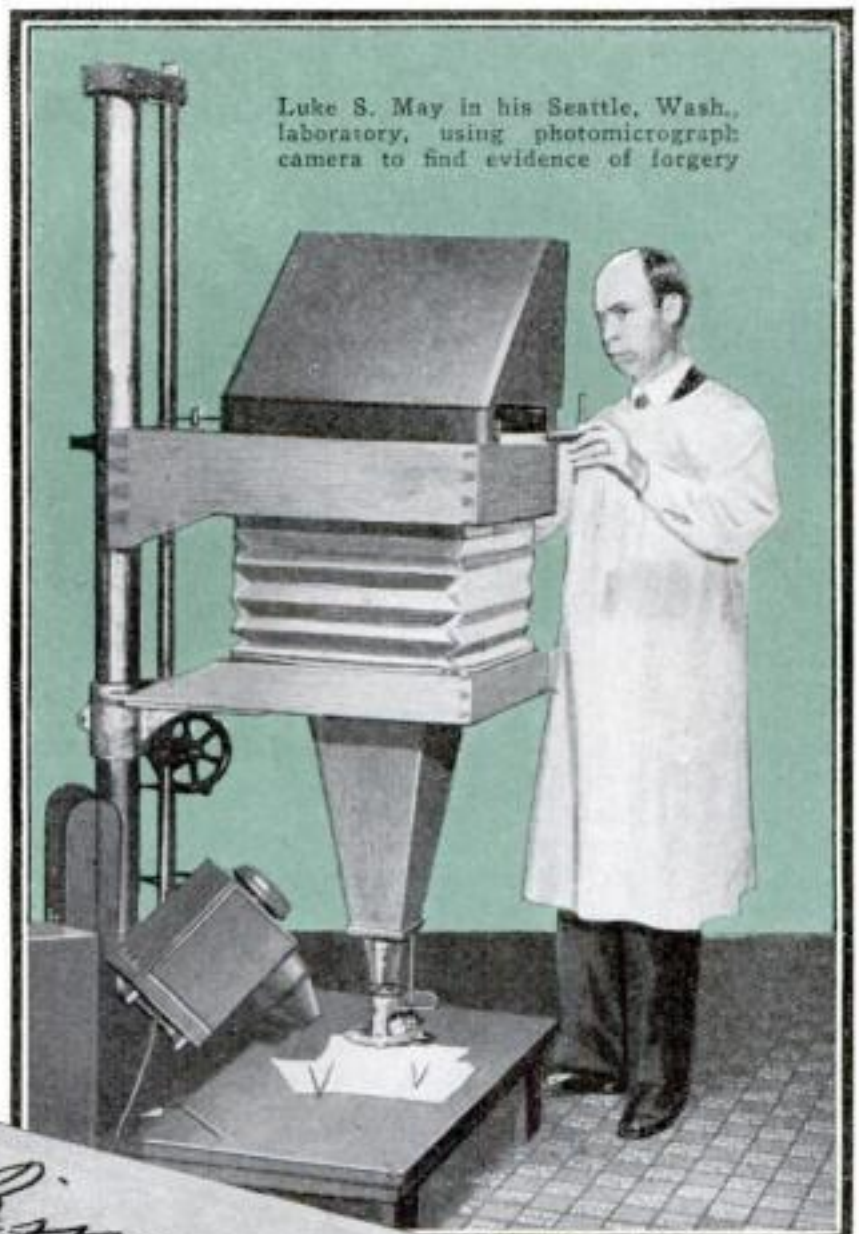
addressed by the two murderers to the father of their victim was a vital clue in running them down. In printing "city," Leopold separated the letters in such a way that the word always appeared as "c it y." Even check marks and crosses may reveal distinguishing eccentricities in pressure or slant.

"Photographic eyed" detectives in Berlin and Dresden, Germany, make the rounds of hotels watching for the writing of noted criminals. Even when the crooks register under assumed names, the formation of the signatures frequently give them away. An average of one arrest a week is the record of the handwriting squads in these cities.

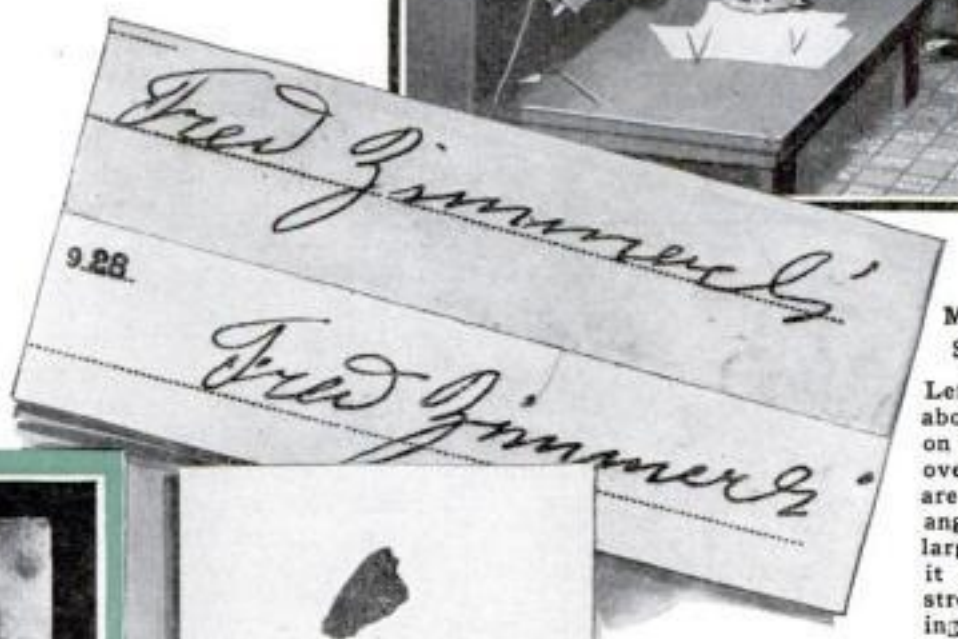
To ferret out in the laboratory distinguishing differences of penmanship, the handwriting detective employs an elaborate scientific apparatus. Strong lights placed beneath glass-topped tables permit minute study of documents. Special magnifying cameras record the strokes and curves of writing and enable the expert to measure them precisely with micrometers accurate to 1/10,000 of an inch. Chemicals and rays reveal the composition of inks and papers. Using such tools, the expert studies every word of a questioned document.

THE shape and shading of letters are vitally important. The width of pen strokes, varying from one three-hundred-and-thirtieth of an inch for fine lines to one thirty-second of an inch for coarse ones, may hold sought-for clues. The slant of up and down lines and the formation of loops and curves all tell their story.

Check forgers, I was told, are often caught through a comparison of the "speed" of writing in their spurious signatures with that in the genuine ones. Under a microscope, a line penned rapidly, as in ordinary writing, is comparatively straight. One "drawn" or written slowly, as in copying, has a ragged, wavering appearance that can be instantly recognized. The most dangerous kind of forgers are the "freehand artists," who practice writing a forged signature until they can dash it off at normal writing speed.

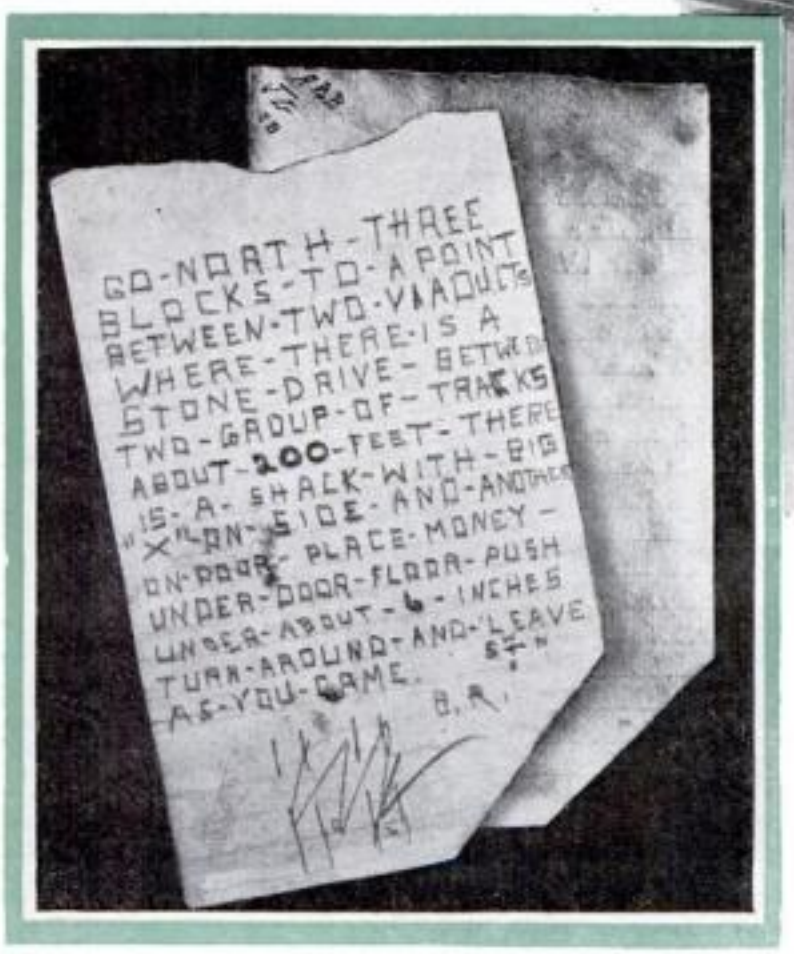


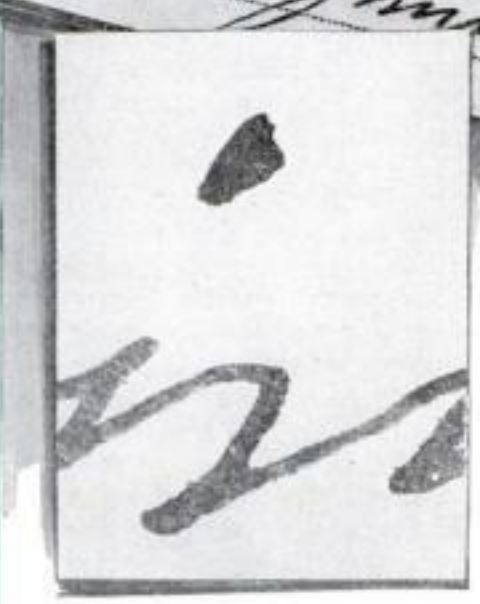
Luke S. May in his Seattle, Wash., laboratory, using photomicrograph camera to find evidence of forgery



MAGNIFIED PHOTO SOLVES MYSTERY

Left, genuine signature above forged name written on false will. Note dots over "i" in lower exhibit are both made at the same angle. Lower left, enlarged photo of dot shows it was made with two strokes of pen, thus proving signature a forgery





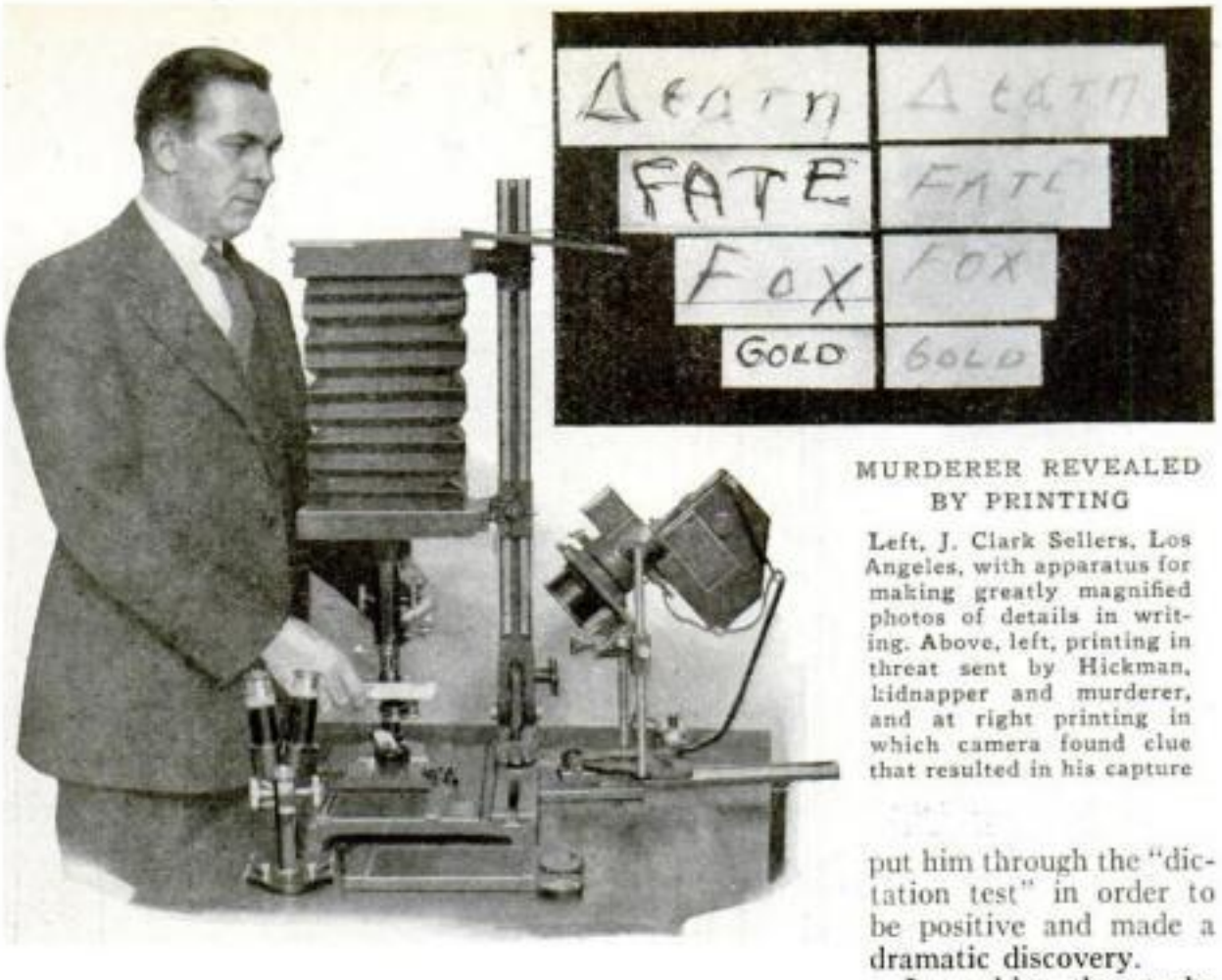
PRESSURE PHOTOGRAPH TRAPS BLACKMAILER

Left, top sheet is a blackmail note. Detectives photographed pad from which sheet was torn, using angular lighting. This brought out indentations of pencil, as shown on back sheet, thus establishing the source of the note and foiling plot

The fact that styles in handwriting have changed frequently in the United States is an aid to the hunter of criminal penmen. Because the vogue of the "round-hand," the Spencerian, and other styles lasted only from ten to fifteen years each, the scientific detective can often determine the age of an unknown writer by the formation of letters in his script. In one instance, the way a writer formed the loop of an "e" proved the document in an elaborate fraud plot had been forged. It showed the effects of a type of penmanship that had not come into use until after the death of the supposed signer!

Similarly, the effects of having learned to write a foreign language before English leaves its mark upon the script of American citizens born in other lands.

To reveal telltale peculiarities in the handwriting of a suspect, an expert usually



MURDERER REVEALED BY PRINTING

Left, J. Clark Sellers, Los Angeles, with apparatus for making greatly magnified photos of details in writing. Above, left, printing in threat sent by Hickman, kidnapper and murderer, and at right printing in which camera found clue that resulted in his capture

dictates a letter for him to write. Albert S. Osborn, dean of American handwriting detectives, originated the form most frequently used for the purpose. It is published in his book *Questioned Documents*. Containing the following eighty words, it gives all the capital letters, small letters, and figures needed for comparison purposes:

"Our London business is good, but Vienna and Berlin are quiet. Mr. D. Lloyd has gone to Switzerland and I hope for good news. He will be there for a week at 1496 Zermott St., and then goes to Turin and Rome and will join Col. Parry and arrive at Athens, Greece, Nov. 27th or Dec. 2d. Letters there should be addressed: King James Blvd. 3580. We expect Chas. E. Fuller Tuesday. Dr. L. McQuaid and Robt. Unger, Esq., left on the X. Y. Express tonight."

This note is dictated several times at increasing speed in order to foil attempts to disguise natural handwriting. The manner in which the strokes are made in penning the words is also noted by the expert. How important this phase of the test may be is illustrated by a case in a western state, a few years ago.

EARLY one morning, a factory manager entered his garage on his way to work. A few moments later, a terrific blast shattered the building, wrecked the automobile it contained, and instantly killed the owner. An infernal machine had been attached to the starter of the automobile by an unknown person, and had exploded when the starter button was pressed.

In the waste basket of the murdered man's library, detectives discovered an anonymous threat crumpled into a ball. It had come the day before. Not taking it seriously, the manager had tossed it into the basket. An expert examined the handwriting and compared it with that of several suspects. In one man's writing he found the stroke of a capital "I" with peculiar shading, almost identical with that in the death note. Police were sure they had the guilty man, but the expert put him through the "dictation test" in order to be positive and made a dramatic discovery.

In making the stroke in the capital "I," which had fastened suspicion upon him, the detective saw that the man always began at the other end of the letter from that used as a starting point by the threat writer, and *made the stroke backward!* This discovery freed the innocent man. Later, a disgruntled factory-worker, found in another state, confessed to the bombing.

I ONCE asked Albert S. Osborn what the chances were of two people writing exactly alike, without any distinguishing traits to set their script apart. He told me he had figured it out mathematically and found it to be about one chance in 68,000,000,000,000. That is, one to thirty-four thousand times the population of the entire globe!

More than that, it is almost impossible for the same person to sign his name twice with all the letters exactly the same size. When the precision instruments of the laboratory show several signatures of the same individual exactly alike, it means they have been traced from a single original.

It was this principle that enabled Osborn to break down the famous $6,000,000 Rice will forgery attempt in New York, some years ago. On each of the four pages of the document, this famous scientific detective told me, there was the signature: "W. M. Rice." The size and shape of the script in every case was identical. By a curious twist of fate, on the very day the will was dated, Rice had written to four friends, placing his signature at the end of each letter. Comparison showed that no two of the genuine signatures had the same measurements. While the writing was unmistakably the same, the size had normal variations.

A letter played an even more dramatic part in another case. To explain the wavering lines in the signature on a fraudulent deed, the forger declared the alleged signer, since dead, was ill at the time. Curiously enough, in the attic of an old friend, a letter written a quarter of a century before, *on the exact day the deed was dated*, came to light. The writing and signature on this missive proved the story of the claimant false.

ONE of the newest rackets in forgery, I am told, is "autographing" old books. On the fly-leaf of a volume published in the time of Benjamin Franklin or Abraham Lincoln, the forger places a carefully-copied and artificially "aged" "B. Franklin" or "A. Lincoln." Thomas F. Madigan, noted New York autograph expert who sold the original manuscripts of Lincoln's Gettysburg Address and Poe's "The Raven," has had more than twenty-five such forgeries offered to him within the past year. Only the other day, he told me, a man brought in an old book that reported the Lincoln-Douglas debates with a forged Lincoln signature on the title page. Undoubtedly many such forgeries are sold to unsuspecting collectors.

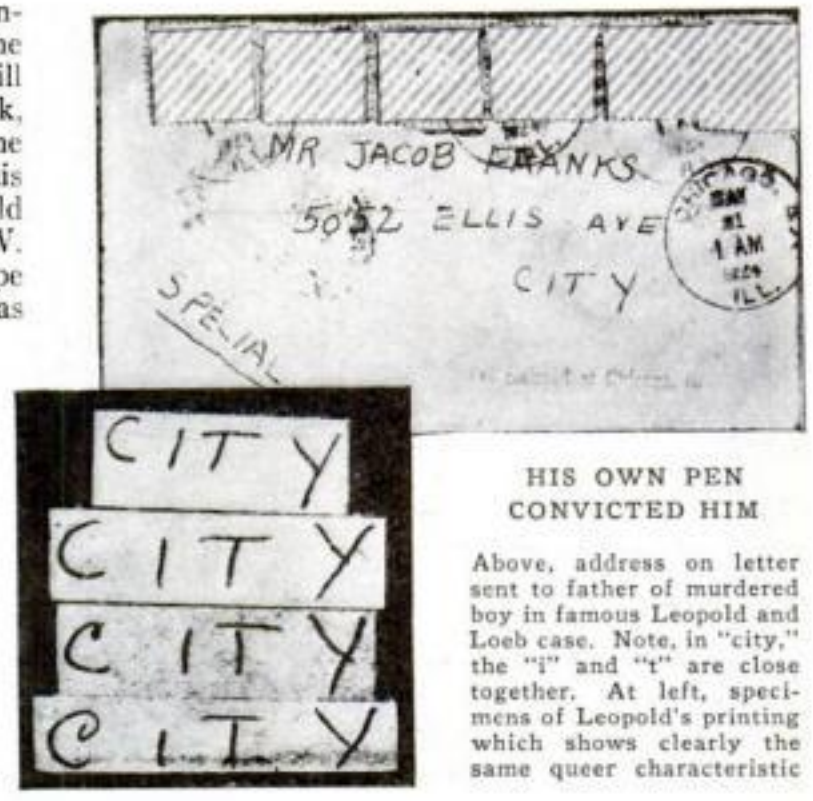
No matter how carefully a forgery is executed, there is almost always something that trips it up. Even the way an "i" is dotted may solve a case under the microscope of the skilled Sherlocks of the laboratory.

As a matter of fact, "Case No. 727" in the files of Luke S. May, the noted scientific criminologist of Seattle, Wash., records just such a feat. Early in April, 1930, Fred Zimmerli, a retired Swiss tailor, died in Seattle leaving a will in his safe deposit box dated February 23, 1928. It bequeathed one-eighth of his $30,000 estate to a daughter by a first wife, living in St. Louis, Mo., and the rest to relatives in Switzerland.

Shortly after the daughter was notified of the terms of the will, she telegraphed the executors of the estate that she had found a later document, dated August, 1928, hidden in one of the shirts that had been sent to her with her father's effects after his death.

In the resulting battle to have this later will recognized, Luke S. May gave sensational testimony in court.

(Continued on page 128)

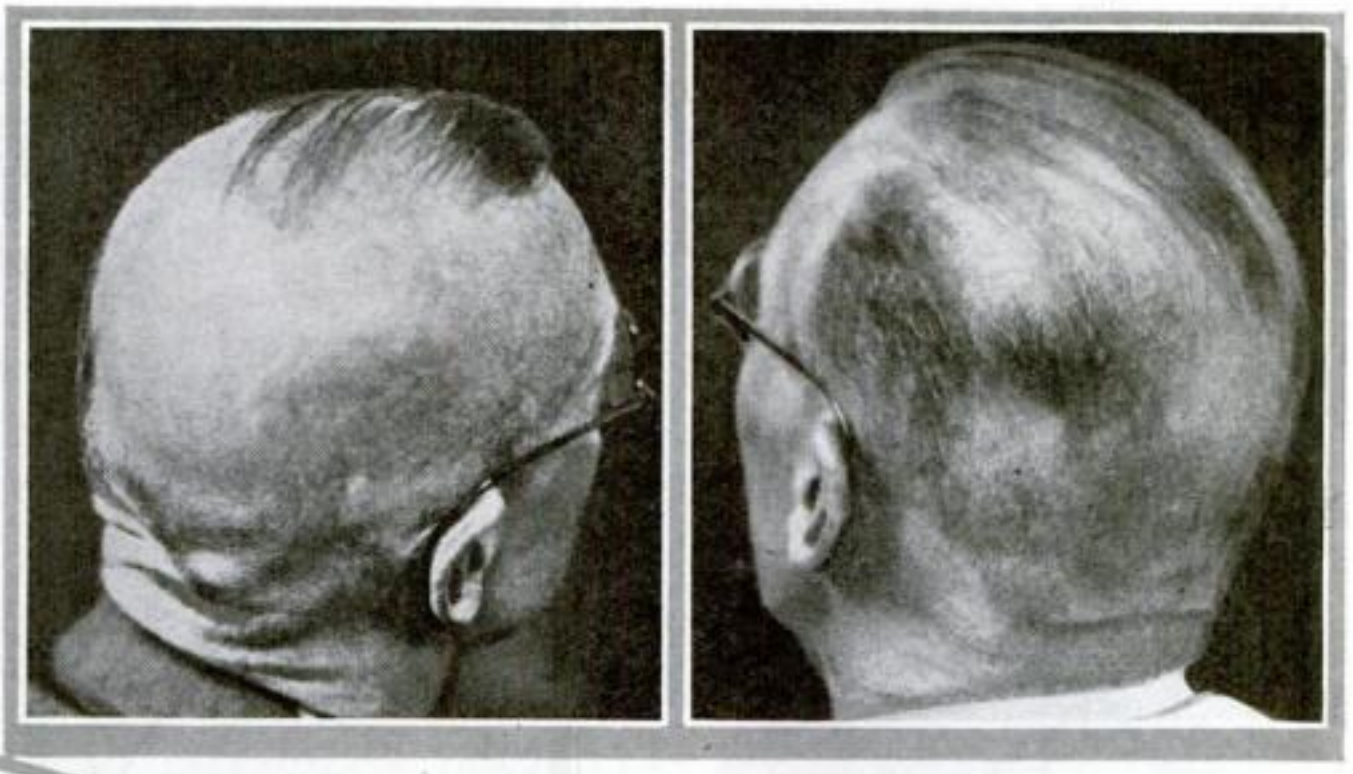


HIS OWN PEN CONVICTED HIM

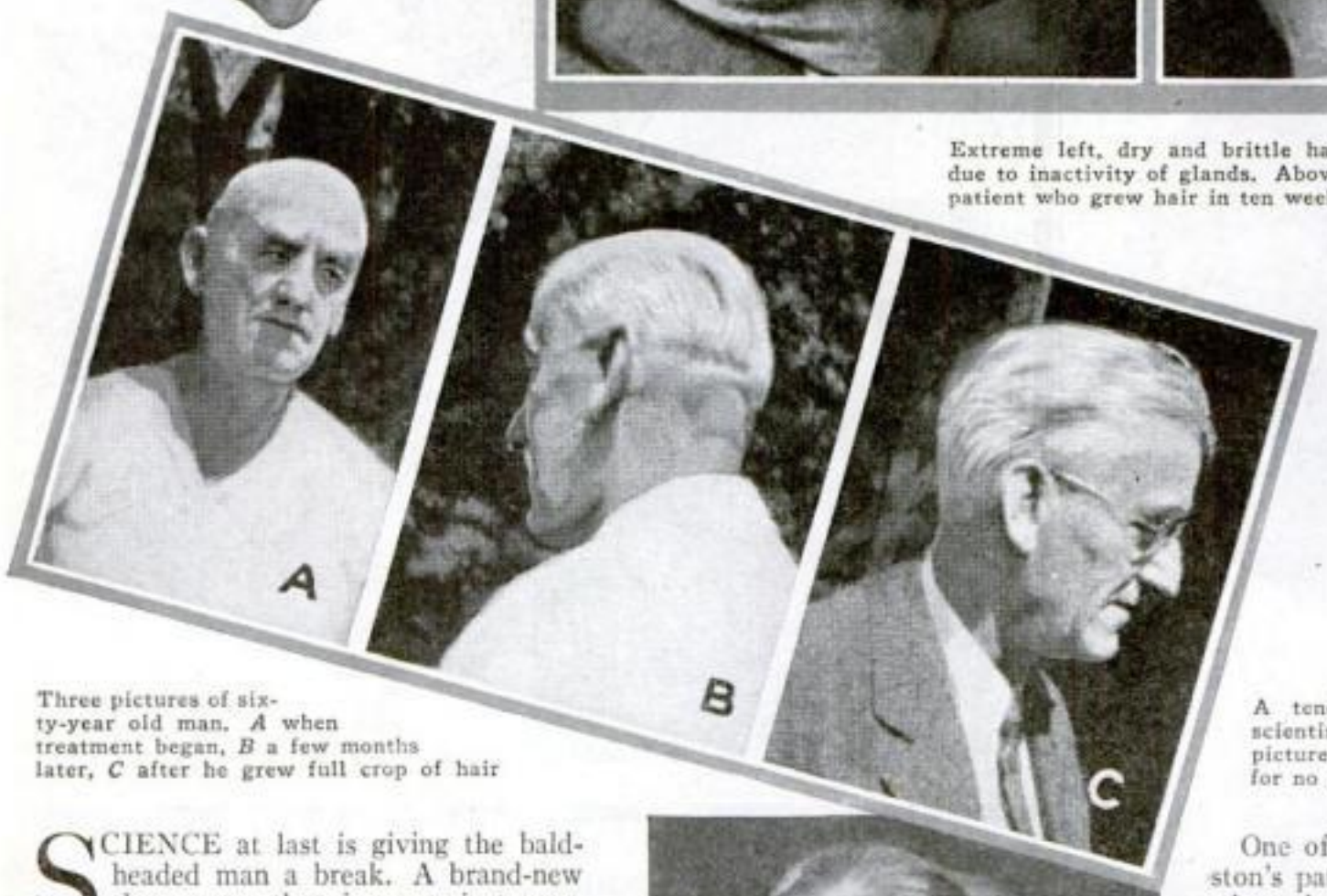
Above, address on letter sent to father of murdered boy in famous Leopold and Loeb case. Note, in "city," the "i" and "t" are close together. At left, specimens of Leopold's printing which shows clearly the same queer characteristic

Gland Extract Makes

BALD HEADS Grow Hair



Extreme left, dry and brittle hair due to inactivity of glands. Above, patient who grew hair in ten weeks



Three pictures of sixty-year old man. *A* when treatment began, *B* a few months later, *C* after he grew full crop of hair

A tendency to baldness, Smithsonian scientists believe, is hereditary, and this picture is of a young man losing his hair for no apparent reason, without dandruff

SCIENCE at last is giving the bald-headed man a break. A brand-new theory says that, in many instances, baldness is caused by a deficiency in the secretions of the endocrine glands. Practical tests of the glandular treatment, at the University of Illinois College of Medicine, have led to remarkable success.

One man, bald since 1914, grew hair in four weeks as the result of daily injections of pituitary gland preparation. Another, bald for eighteen years, grew a visible amount of hair in three weeks.

The expert in charge of these revolutionary experiments, Dr. B. N. Bengston, of Maywood, Ill., makes no sweeping claims for his new treatment. He reports, though, that the results on sixteen patients were "striking." "It seems that coincidence could be ruled out," he says, "by the uniform success in these sixteen patients, most of whom tried various kinds of other treatments."

Most of the sixteen patients treated during the recent Illinois tests were bald at a comparatively early age, and, according to Dr. Bengston, were suffering from "glandular baldness."

Monkeys, like men, get bald, as this photo shows, and probably for the same reason

Hypodermic injections, in most cases once a day, were administered with uniform success, treatment in a majority of cases being suspended as full growth of hair was restored.

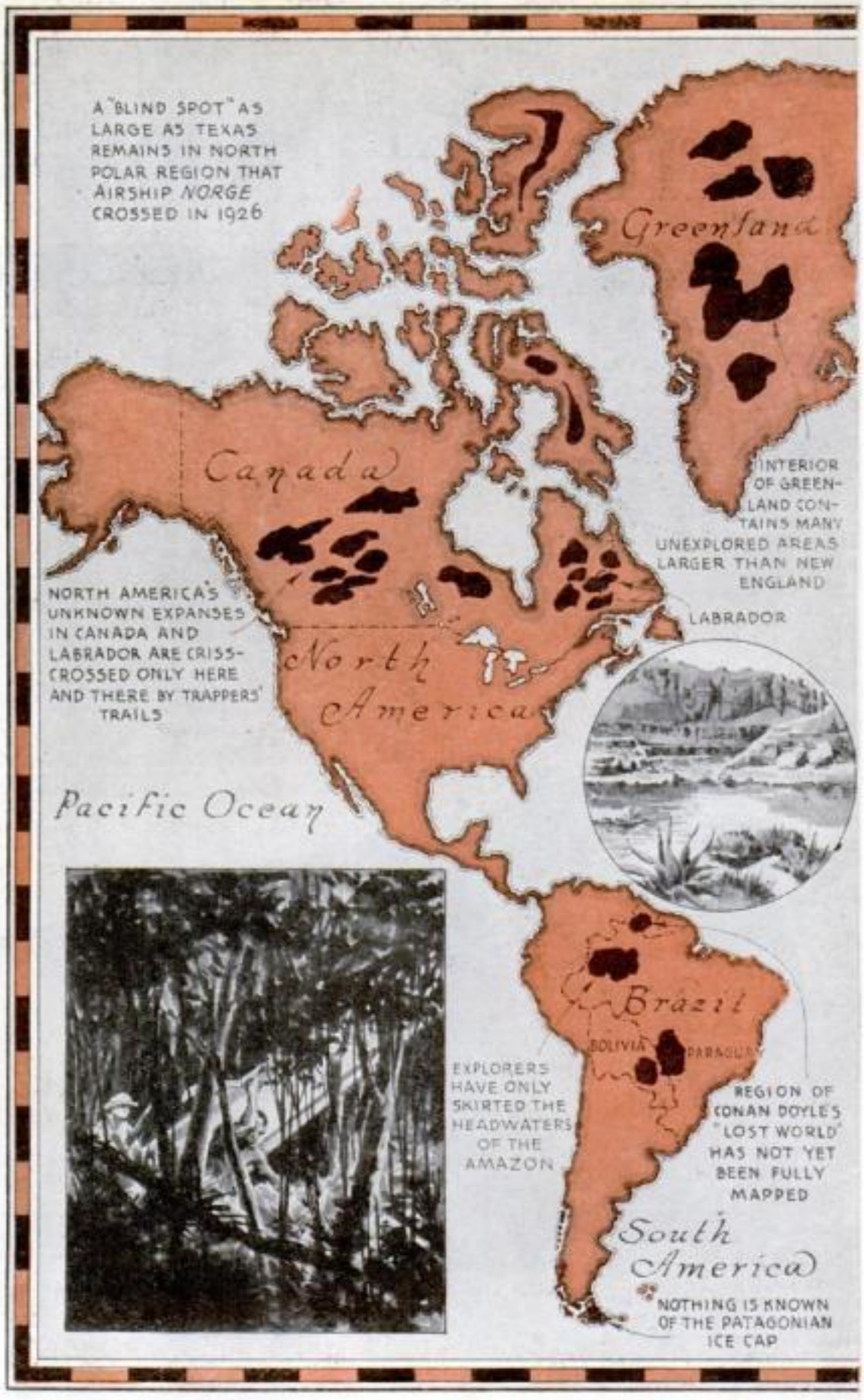
One of the most unusual of Dr. Bengston's patients was a man sixty years old whose hair suddenly started to fall out four years ago. Within three months he was totally bald. A study of his history showed that he had been afflicted with rheumatism for six years. He began receiving pituitary gland injections in February, 1928. In August, 1928, a slight fuzz appeared. Five weeks later his entire head was covered with down, and early in February, 1929, he started to grow a crop of true white hair. By May he had a full growth of white hair.

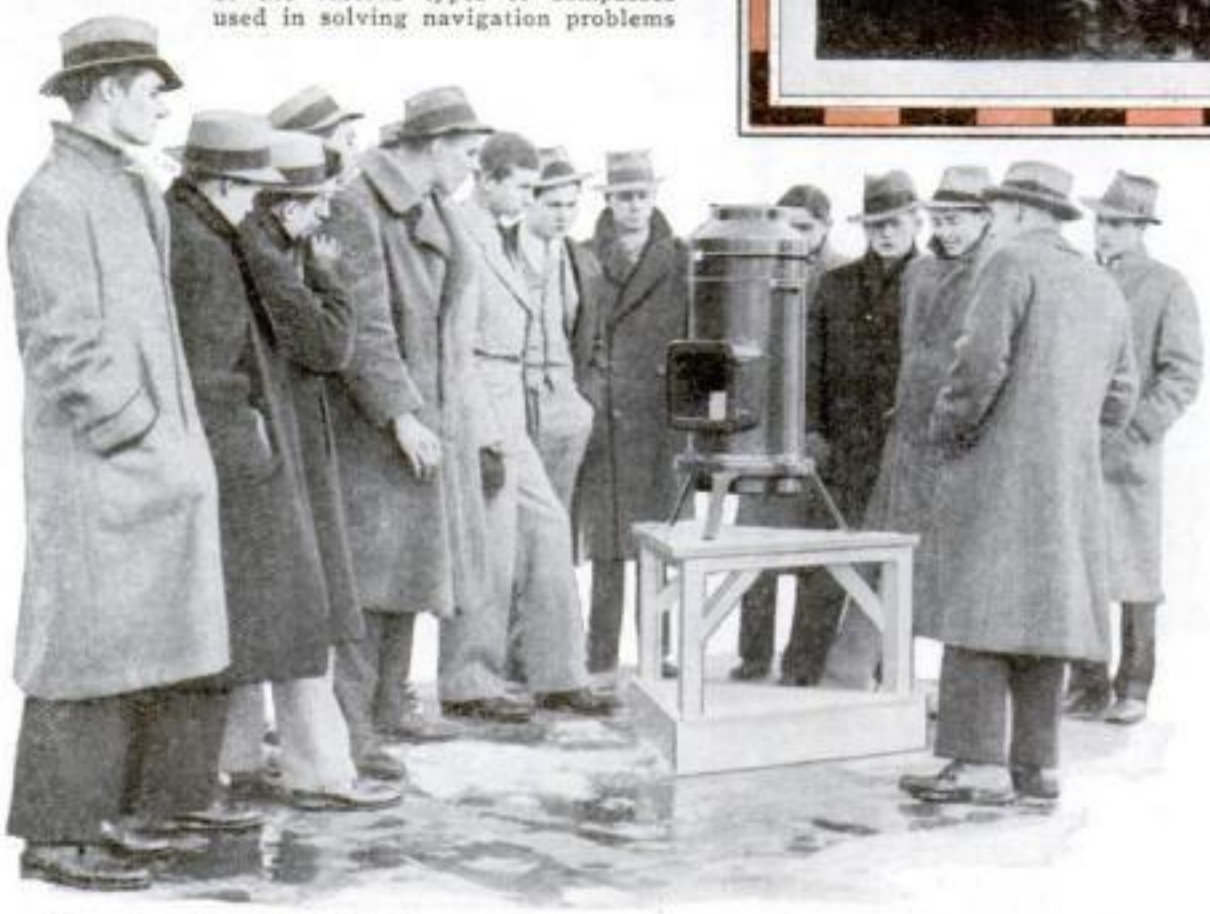
Another outstanding case was that of a youth, eighteen years old, whose hair began to fall out in large patches one summer, the baldness continuing to develop increasingly larger areas.

The pituitary treatment in his case began in April, 1928, and by December the entire head had a noticeable surface of down. Early the following February true white hair started to replace the down. By September 10, 1930, the eyelashes and eyebrows were regained.

Science of *Exploration* Now Taught in COLLEGE

A student in the Harvard exploration class is initiated into the mysteries of the various types of compasses used in solving navigation problems





Preparing for a scientific effort to penetrate the unknown portions of the earth, these students in Harvard's exploration class are here learning all about the rain and snow gage that has been mounted for the use of the students on the roof of a university building

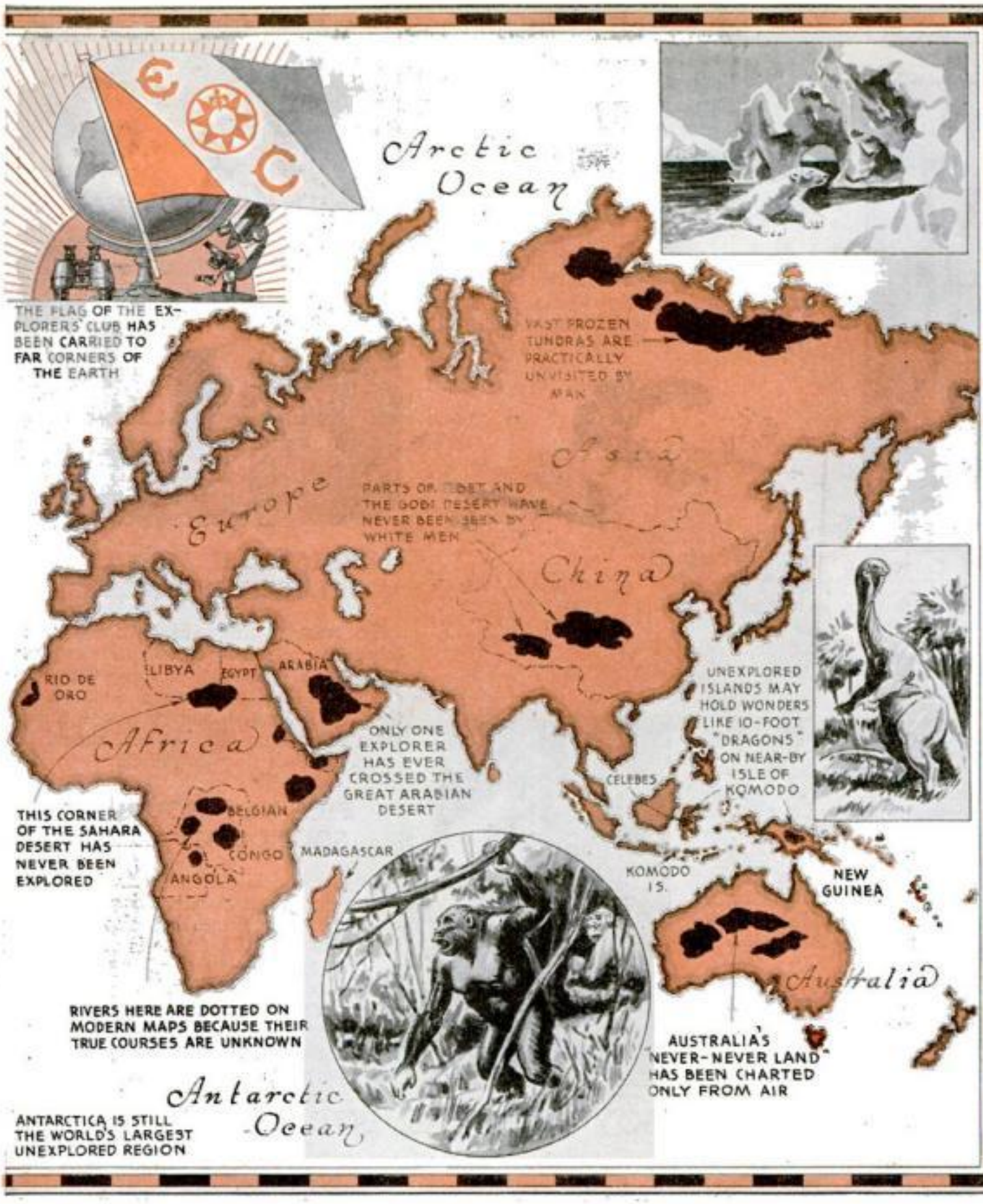
All the world is not yet explored, and the

WHAT is said to be the world's only school for explorers has just been opened at Harvard University, Cambridge, Mass., under the name of the Institute of Geographical Research. Here young aspirants for adventure in strange lands will learn how to read a compass, set up radio communication with civilization's outposts, make their own weather forecasts, and record valuable scientific data. A graduate will be qualified to command an expedition.

Opening of this school is a reminder that, even in this age of airplanes and fast travel, much of the world is still unexplored. Some of the vast areas of the earth's face that await the tread of white men are shown on the accompanying chart, based upon a recent compilation.

Because of their inaccessibility, unexplored lands are the more likely to hold strange sights. Viewing the isolation of steep-sided Mt. Roraima on the Venezue-

Many Unknown Spots in World Still Challenge Trained Adventurers



black spots on this map indicate the remaining unknown portions

lan border, the late Sir Arthur Conan Doyle imagined its wild life to be untouched by outside forces of evolution, and therefore different from any to be found elsewhere. He made the plateau the scene of his famous novel, *The Lost World*, and peopled it with cave dwellers and dinosaurs surviving from prehistoric times. That his ideas had at least some scientific basis was shown several years ago when explorers found birds and animals entirely new to science, though no dinosaurs, upon the summit.

Meanwhile monsters not unlike dinosaurs have been discovered in another part of the world. Natives of the little Dutch East Indian island of Komodo told of seeing "dragons" bigger than men. Investigating, explorers found the island inhabited by giant lizards ten feet long.

Only further exploration can verify or disprove equally bizarre legends, such as that of the "Man-Eating Tree" of Madagascar. According to native myths, its octopuslike tentacles close upon and crush human victims, and legend speaks of a little-known tribe that offers human sacrifices to the tree. So far this botanical horror, a gigantic counterpart, if it exists, of "carnivorous" plants that trap and eat insects, has proved elusive to explorers.

How near to home some "finds" may lie was demonstrated recently by the discovery of a "Great Wall of Peru," equaling, as a world's wonder, the celebrated rampart of China, in an area already thoroughly criss-crossed by expeditions. Why it remained unknown until now is as great a puzzle as its origin.

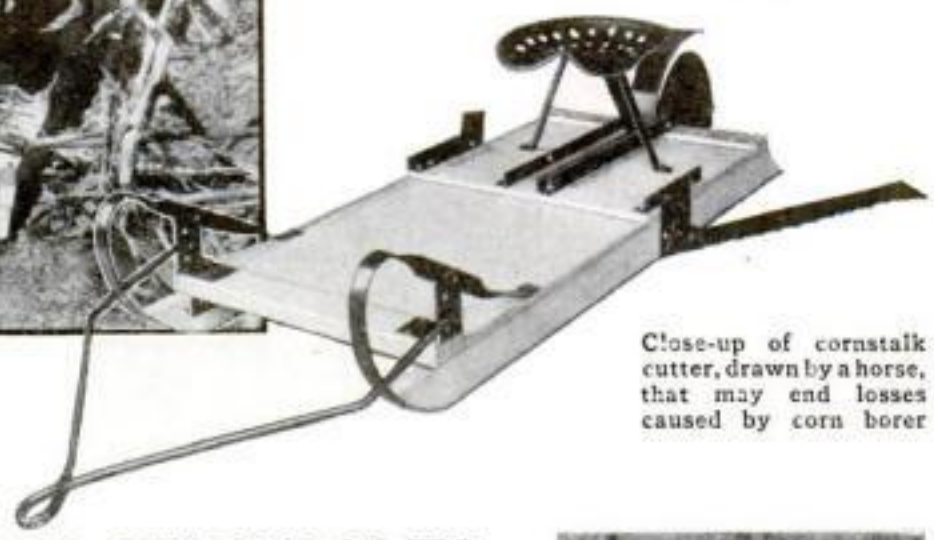
Thus fascinating mysteries await the college trained explorers. Huge blank spaces remain to be filled in on the map of the world's face, to say nothing of the unexplored vastnesses of the sky ten miles or so above the earth and the sea but a quarter-mile beneath the waves.

This weather vane, working day and night, automatically records velocity and direction of wind. Student explorers are taught how to read its data for use in weather forecasting

SLED SHAVES CORNFIELD TO KILL PEST

Knives on this new machine shear off corn stubble to destroy predatory insect that hibernates in the uncut stalks

A STRANGE "sled" that gives cornfields a shave is the United States Department of Agriculture's latest weapon in its fight against the European corn borer. This destructive insect hibernates during the winter in the stubble left standing above ground after the corn is cut. When the horse-drawn sled shown here is towed across a field, two spreading knives shear off the stalks flush with the ground, while a guide wheel at the rear steadies its course. The refuse is raked up and burned, thus effectively destroying the pest.



Close-up of cornstalk cutter, drawn by a horse, that may end losses caused by corn borer

SHORT TOOL CUTS BOLTS

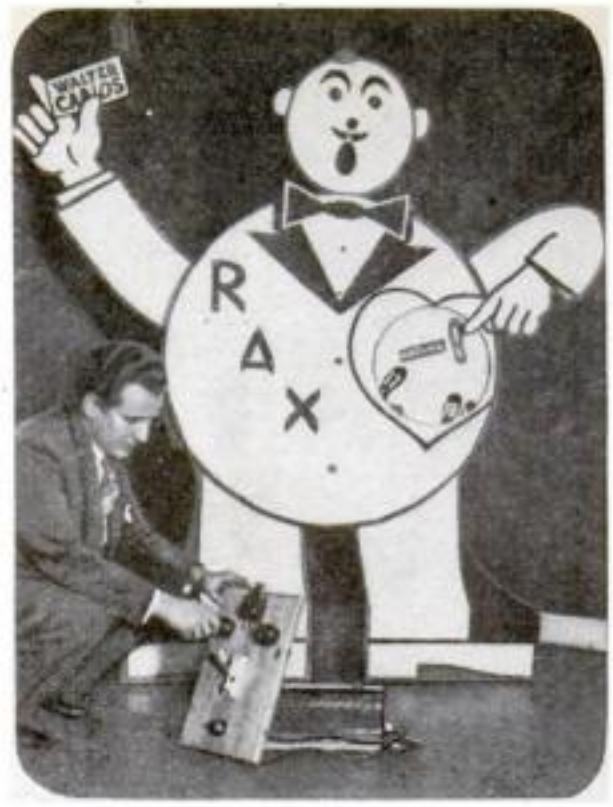
LESS than eight inches long, a new heavy-duty tool can cut off bolts and rods with ease. It may be used in cramped quarters because of its compactness. This is made possible by the use of a powerful screw, instead of hand levers, to actuate the jaws. An ordinary half-inch ratchet wrench is used to turn the screw. In the illustration, the tool is cutting nuts from the strap bolts of an auto gas tank. Bolts three eighths of an inch thick and round stock five sixteenths of an inch thick can be cut by the tool.

At right, hand bolt-cutting tool that bites into steel under impulse of power applied by screw

UMBRELLA AIDS CLIMB UP TALL SMOKESTACK

WHEN painters were called in to work on the seventy-foot steel smokestack of a midwestern power plant, not long ago, they found no ladder had been installed to provide a means of reaching the top. An ordinary umbrella, hastily pressed into service, solved their problem.

With a light cord attached to its handle, the opened umbrella was thrust through the soot door at the base of the stack, nine feet in diameter. Warm gases from the boilers created a powerful upward draft and swept the umbrella up the stack and out the top. Here, deprived of its lifting force, the umbrella slid to earth, still trailing its cord. Waiting hands then attached a strong rope to the cord and carefully hauled it through. With this aid a steeplejack was able to gain the top of the stack, from the outside, and fasten his temporary painting rig.



MECHANICAL MAN LEADS CLASS IN DANCING

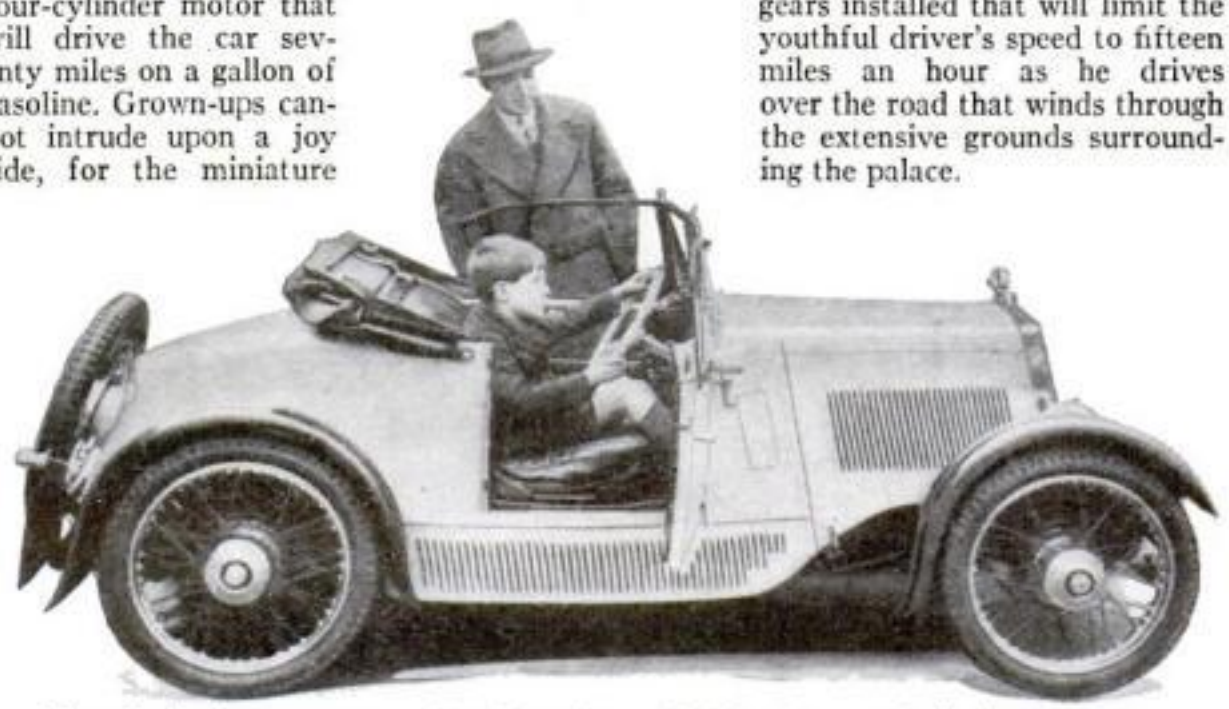
TO MAKE more vivid his instructions to novices, a German dancing master built an electrical robot that performs the proper steps in time to the music. At the same time, the animated figure points to a diagram illustrating how the feet should be placed at each stage in the dance.

FIRE EXTINGUISHER SOUNDS AN ALARM

IF FIRE should start unnoticed in home or factory, a new wall extinguisher not only fights the flames but also calls for help. The heat of a match is sufficient to melt a fusible link and release a powerful spring. Its blow smashes a glass container, releasing a stream of carbon tetrachloride liquid that turns to gas and smothers the flames. At the same time a blank cartridge explodes, giving the alarm.

BUILD BOY-SIZE CAR FOR PRINCE'S SON

WHAT is called the most luxurious car ever built to order for a boy has just been completed in England for the eleven-year-old son of an Indian prince, the Maharajah of Jodhpur. Beneath the hood is a four-cylinder motor that will drive the car seventy miles on a gallon of gasoline. Grown-ups cannot intrude upon a joy ride, for the miniature seats, as well as the steering wheel and controls, are boy-size. In all respects save one, the car might typify the fondest daydream of an average American boy. The cautious Maharajah has ordered special gears installed that will limit the youthful driver's speed to fifteen miles an hour as he drives over the road that winds through the extensive grounds surrounding the palace.



Every boy's dream came true when this real car, of midget size, was built for the eleven-year-old son of an Indian prince. Special gears hold its speed to fifteen miles an hour

At right, Clarence A. McAntire, Joplin, Mo., dentist, who carves ivory ornaments, above

DURING off hours, a Joplin, Mo., dentist uses his drills for a less painful process than the treating of patients' teeth. His hobby is the carving of delicate ornaments in ivory. Billiard balls, cut to appropriate size, furnish him with raw material. By the careful use of dentists' tools, as illustrated above, he produces exquisite and intricate designs. Among his best are a miniature human skull, an Egyptian scarab luck piece, and a strutting peacock, each of which is shown in the picture at the left, together with other products of his skill.

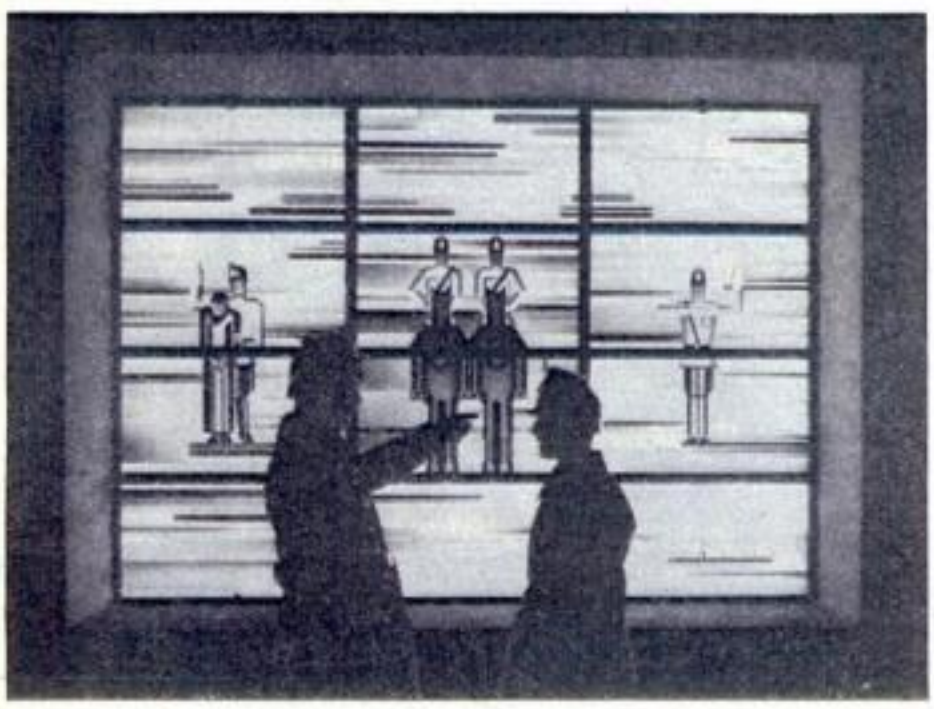
TYPEWRITER QUIET

UTILIZING a principle already applied in sound-absorbing materials for building walls, a new noiseproof pad for the typewriter provides a firm base but suppresses the clatter. The usual felt pad is covered with a durable and sanitary top of perforated metal, through which the noise passes and is absorbed below. They are made to fit any standard typewriter.

SPOTLIGHT ON HELMET AIDS NIGHT MOTORIST

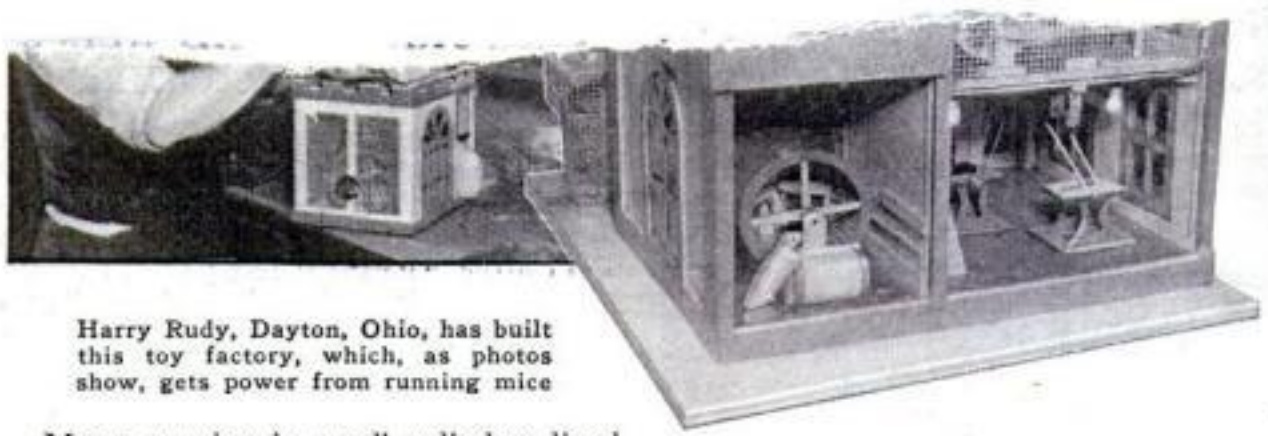
LIKE a miner's headlamp is a new helmet for motorists, recently exhibited in London, England. An electric bulb aids night driving by directing a beam of light upon a road map, gasoline tank, or motor. The motorists' hands are thus left free, and repairs or adjustments are easily made to the machine. A battery supplying current to the lamp is self-contained in the novel headgear, so that there are no loose wires to interfere with the users' movements.

PUT STAINED GLASS IN POLICE STATION



Modernistic stained glass window designed for Berlin police station

STAINED glass windows have hitherto been seen almost exclusively in churches, but a German craftsman has adapted them to other purposes as well. His modernistic designs have brought the ancient art up to date for the decoration of public buildings. A typical example of his work is seen at the left. It consists of an ornamental pane for the window of a Berlin police headquarters, with tinted figures in characteristic poses.

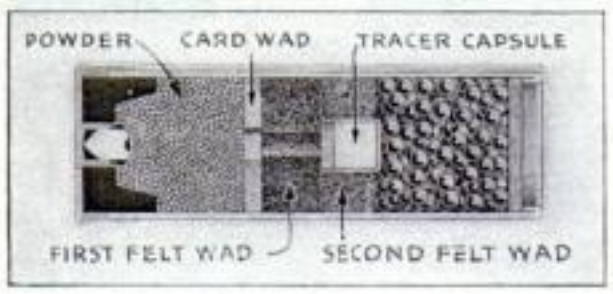


Harry Rudy, Dayton, Ohio, has built this toy factory, which, as photos show, gets power from running mice

MICE, running in small cylinders lined with corrugated cardboard, furnish the motor power for a toy factory recently contrived by Harry Rudy, Dayton, Ohio. The factory is divided into an upper and lower story. In three cylinders in the upper story, twelve trained rodents run, causing them to turn and transmit their power to tiny machines below. The mice workers live in a cage connected to the factory by a long tunnel. In the morning Rudy summons them to work by opening a connecting door and turning on a light. At night a blast from a horn sends them to their cage.

...EARSAL

A WAX dummy serves as critic during the orchestra rehearsals of Leopold Stokowski, famous conductor. Named "Oscar," it sits through a performance at the Philadelphia Academy of Music with an impassive expression on its molded face. But its ears never miss a note, for they are twin microphones connected to an amplifying system and earphones. By listening in, engineers can determine the best arrangement of the orchestra for radio broadcasting purposes.



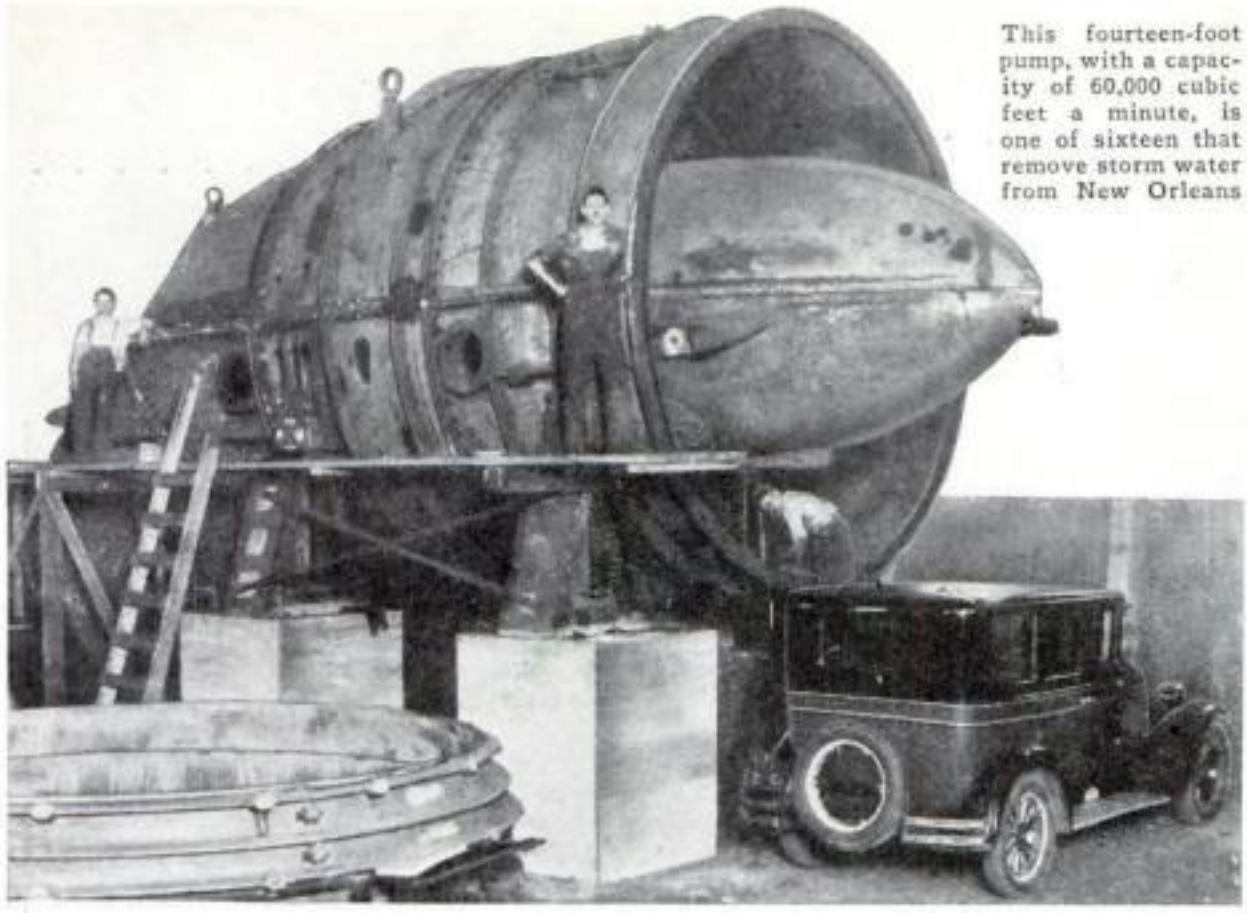
SHELL'S FIERY TRAIL AIDS GUNNER'S AIM

TRAP shooters may now correct their faults with the aid of a tracer shotgun shell, recently placed on the market. Like the tracer bullets in military use, it leaves a fiery trail plainly visible even in daylight. The light comes from a capsule of pyrotechnic material so placed that it travels almost exactly in the center of the shot pattern. The new shell is not intended to be used in hunting, since it would render game unfit to eat, but it is useful in practice for checking the accuracy of the gunner's aim. A cross section drawing, above, shows the construction of the practice shell.

WIND OR ELECTRICITY DRIVES SAILING SHIP

A HUGE electrified yacht just completed at Kiel, Germany, for an American runs either under the power of her 4,000 square yards of canvas or a Diesel-electric power plant. Four 800-horsepower oil-burning motors drive the dynamos. The sails are handled by electricity, and when the skipper desires to run under sail alone, a "free-wheeling" clutch releases the propellers, allowing them to idle. This eliminates resistance as they drag through the water. So well concealed is the yacht's mechanization that outwardly she resembles a sailship.

NEW ORLEANS GETS BIGGEST PUMPS



This fourteen-foot pump, with a capacity of 60,000 cubic feet a minute, is one of sixteen that remove storm water from New Orleans

THE LARGEST pumps in the world are now draining storm waters from the city of New Orleans, La. Twelve of these monsters, their size evident from comparison with the men and car in the photograph above, were in operation at this writing. The system, when it is completed, will have sixteen of them.

Each fourteen-foot pump can discharge 60,000 cubic feet of water, or enough to fill a half-mile train of tank cars, every minute. A steel-bladed screw, whirled like an auger bit by a powerful motor, propels the water. New Orleans is built within a natural bowl, with no outlet for rain water to flow by gravity to the Mississippi River. This explains the need for a pumping station with the amazing capacity, including its smaller pumps, of 28,800 cubic feet a second. To visualize such a torrent, consider that only seven pumping stations of this size would be required in order to duplicate the imposing cataract that pours over Niagara!

MACHINE TESTS HOOVER DAM CONCRETE

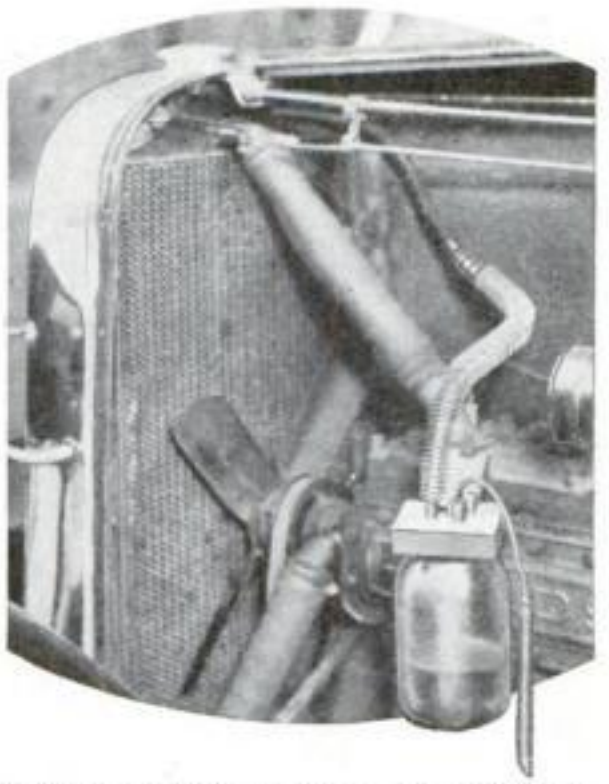
Concrete pillar for Hoover Dam ready to be tested

WHAT kind of concrete will go into Hoover Dam, the mighty structure soon to block the Colorado River for water supply and electric power, is being decided in a Denver, Colo., research laboratory. Giant cylinders of concrete, mixed according to various formulas, each block as tall as a man and three feet thick, are fed to a testing machine that can exert a crushing force of more than 3,000,000 pounds. The final mixture will be selected from those that are most successful in withstanding the enormous pressure. Such tests are necessary because no dam ever built even approaches the projected 727-foot height of Hoover Dam. Hence there is no experience to guide the engineers in specifying the type of concrete to be used in the huge structure.

Only this was left after testing machine finished with pillar

ILLUMINATED MENU IN DIMLY LIGHTED CAFE

ILLUMINATED menus now come to the aid of restaurant diners wherever the lights are low. A bulb is fixed in the menu holder, shedding its beam upon the inserted card at the touch of a button. The battery is carried in a clip at the side, in a case resembling that of a flashlight.



LOST RADIATOR ALCOHOL CONDENSED AND SAVED

SINCE alcohol lost from a car's radiator during the winter months means not only wasted money but danger of freezing, many inventions have been designed to recover it. Latest of these is an attachment for the radiator overflow pipe consisting of a pipe surrounded by cooling fins and a glass jar. Alcohol vapor, escaping from the overflow, is condensed on reaching the finned section and drips into the jar, where it is recovered. A glance at the jar shows how much has been collected for reinsertion in the radiator.

FIND NEW URANIUM ORE

A BROWN mineral rich in the radioactive substance uranium, hitherto unknown to science, has just been discovered near Spruce Pine, N. C., and named "Clarkeite." The find is important because so few ores of uranium are known.

BULLET-PROOF CYLINDER IS BANDIT TRAP

Drawing shows steel cylinder and the way it is used to trap a would-be bank robber

BANK robbers well might quail before the latest mechanical contrivance devised for their downfall. This is a steel "bandit trap" of which its Oklahoma inventor recently exhibited a full-sized model. The device is a hollow cylinder of bullet-proof steel moving on casters, and just large enough for a man to stand inside. One or more, manned by special policemen, would stand ready for action in a bank lobby. Should a bandit attempt a hold-up, he would find himself pursued by one of the rumbling cylinders. Covered by a gun, he would be commanded to drop his weapons and place his hands in apertures in the shell, where they would be made fast by handcuffs.

STAMPS GUMMED RINGS ON LOOSE-LEAF SHEET

A HANDY new device speeds the task of applying gummed rings around the holes of loose-leaf sheets. Resembling a rubber stamp, it holds 100 rings, one of which is deposited each time the end is moistened and pressed down upon a page. A central plunger, which disappears when pressure is applied, centers the reinforcing patch. Refills are packed in cylinders and may be inserted in the device in a moment.

BROADCAST WAVES MAY REACH MARS

IF INTELLIGENT beings inhabit Mars, they may have received a radio broadcast from the earth the other day. That the ultra-short waves transmitted in a narrow beam from the roof of an East Pittsburgh, Pa., laboratory possibly reached our neighbor planet was announced by engineers of the Westinghouse Electric and Manufacturing Company, after testing a new outfit that broadcasts waves of hitherto unequaled power for a wave length as low as less than half a meter. A curved metal mirror was used to focus them in the manner of a searchlight. Ordinary radio waves are stopped by the Heaviside layer, an electrified zone of the earth's upper atmosphere, but engineers now believe that the extremely short radio waves can pierce this layer and travel the 35,000,000 miles to Mars. However, no efforts at interstellar communication will be made with the beam, which primarily is intended for local use and television tests.

From this apparatus went out waves that may have reached Mars. The curved reflector, seen endwise, threw the ultra-short radio waves, believed to have pierced the Heaviside layer

In circle, a short, portable telescope that has power equivalent to much longer instrument. Above, eyepiece in front of a telescope that rests on shoulder so no tripod is necessary

SHORT TELESCOPES HAVE POWER OF LONG ONES

STRANGELY unlike their long-barreled forebears are latest styles in telescopes.

A sawed-off instrument that is as portable as a camera and looks like an overgrown half of a pair of field glasses is shown in the upper photograph. Through the use of an ingenious combination of lenses and prisms, the short barrel gives the equivalent magnifying power of a much longer instrument.

You look in the front, instead of the rear, of the odd telescope shown in the lower photo. This instrument needs no tripod, for it rests on the shoulder and may be steadied against a tree or a post. Rays of light entering the telescope travel first to the rear, then to the front, and back to the eyepiece.

HARVEST COTTON PLANT

RECENT experiments show that the cotton grower may soon be able to reap a greater profit by mowing the whole plant down—boll, leaves, and stalk—and selling it entire to be used in making artificial silk.

GUNMAN'S LIGHTNING DRAW SHOWN IN PHOTOS

J. H. Fitz Gerald, firearms expert, demonstrates fast two-gun draw

Below, Fitz Gerald shows three steps in a quick draw with the left hand. First, note angle of holster. Second, finger is on trigger and gun is on its way out. Third, shooting from hip. Right, with left arm disabled, gunman draws with right hand and fires with the revolver upside down

Special, snub-nosed big caliber gun designed by Fitz Gerald. He calls it "the meanest made"

BEATING the other man to the draw meant life or death to the two-gun Westerner of an era not long past. With modern weapons and a new technique, the speed of the old-time "bad man" can be surpassed, as is demonstrated by J. H. Fitz Gerald, firearms expert and lecturer of Hartford, Conn., in photographs posed for POPULAR SCIENCE MONTHLY. The "quick draw," illustrated in the lower series of photos, is executed so quickly that the eye cannot follow it. To speed up the draw and improve the aim, the marksman bends his body backward. His finger is on the trigger as the gun comes out of its holster.

With one of his arms disabled, the expert uses his other arm as shown in the upper photographs. In this case the pistol is fired upside down.

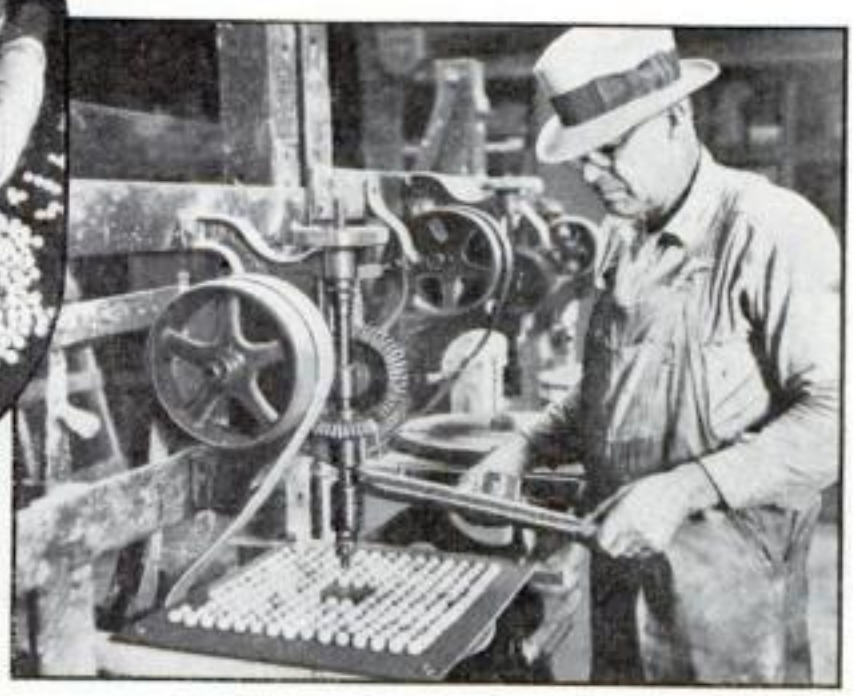
PADLOCK IN COAT FOILS THIEVES

SEWED with invisible stitches into the lining of a valuable coat or dress, a tiny padlock introduced by a German manufacturer protects the garment against theft. When the lock is snapped tight over a closet bar or coat hook, the coat cannot be removed without tearing it to pieces until the owner arrives with the key.

INSTRUMENT MEASURES STARS OR TEETH

THE same tool that astronomers use to measure the size of stars now serves, in slightly modified form, to test the merits of dental fillings. A compact new "interferometer" for this purpose has been perfected and placed on the market by an Eastern firm. For the test, a small sample of the freshly-mixed amalgam is placed on a block beneath the instrument. Sighting in the eyepiece, the observer can watch the amalgam "set" and tell whether the shrinkage is so great that it would fall out if used in a patient's tooth. The instrument makes its delicate measurements by the use of light fringes.

Working on the principle of the astronomical interferometer, this instrument measures tooth fillings



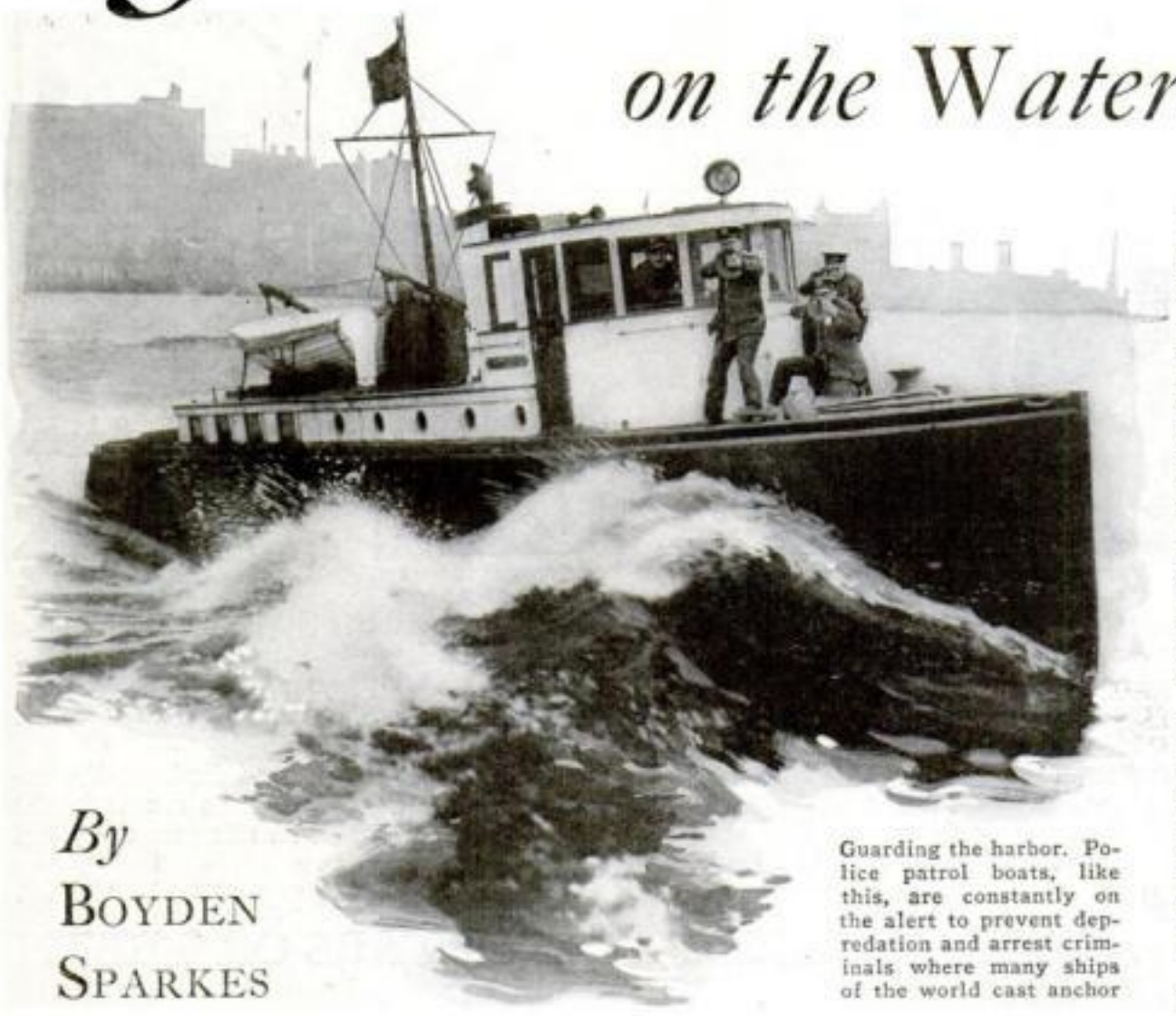
Above, Frankie Mitchell, Los Angeles, Calif., has no shortage of marbles, for his father makes them in the factory shown at the right

MARBLES OF ONYX MADE BY THE TON

YOUNG Frankie Mitchell, of Los Angeles, Calif., is the envy of his playmates, for his father owns the California concern that is said to turn out the majority of agate marbles used in the United States.

Four-ton blocks of onyx furnish raw material from which the "aggies" are made. The blocks are neatly sliced into slabs seven eighths of an inch thick, and these in turn are cut into cubes. Then the cubes are carried, in trays of 200, to a rotary grinder where they become spheres. After a final polishing and calipering for size, the marbles are ready to be sold. Judging from Frankie's plentiful supply in the picture, a goodly number never reach the market.

Fighting CROOKS *on the Waters of a Great*



Guarding the harbor. Police patrol boats, like this, are constantly on the alert to prevent depredation and arrest criminals where many ships of the world cast anchor

By BOYDEN SPARKES

AS A night watchman on a Long Island City pier, projecting into the East River at New York City, lifted his eyes, a shaft of light from the headlamps of an automobile pierced the darkness. The car was being driven down a "dead-end" street that ended at the river bank.

The shaft of light reached farther and farther into the mysterious blackness, and then, before the watchman could cry a warning, the streak of light turned downward and the car plunged into the river, deep enough at that point to engulf a six-story building. Running to a telephone, the horrified watchman shouted his alarm into the ear of an unseen but placid-voiced policeman.

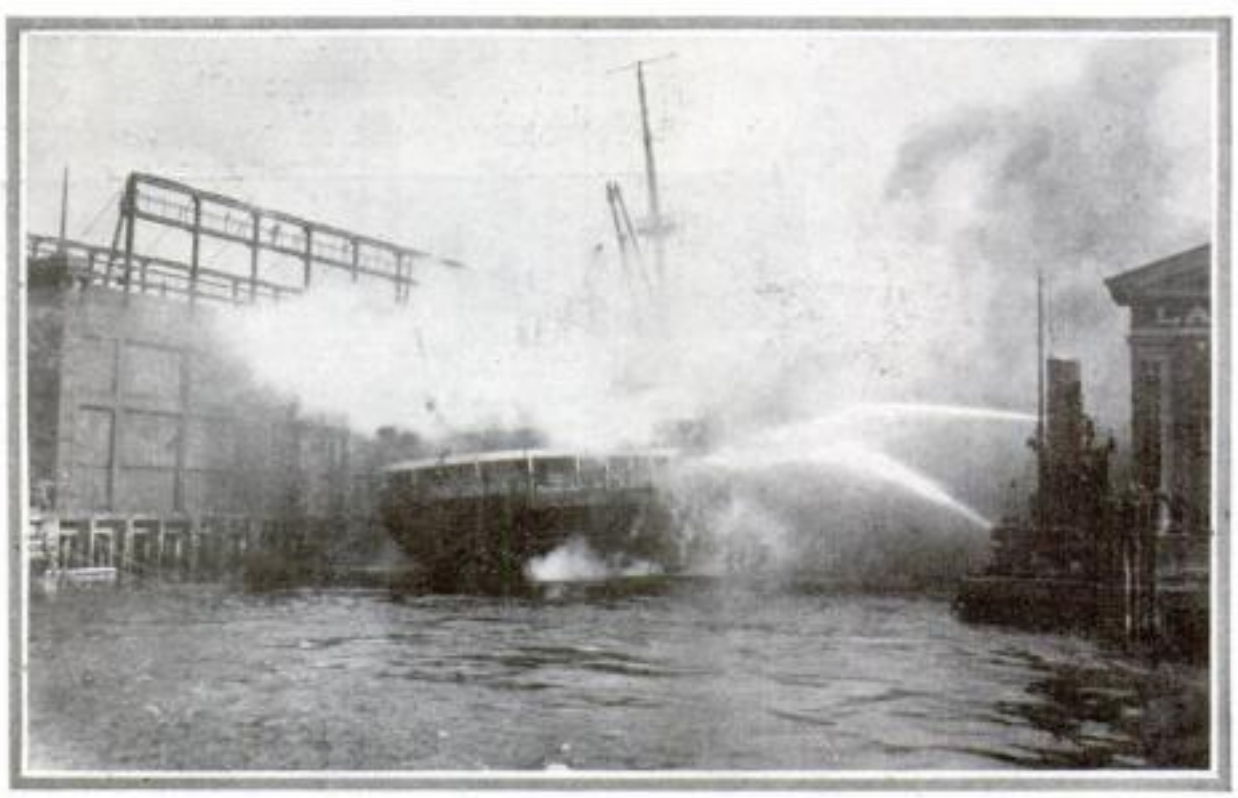
Even to the impatient watchman it seemed only a moment before a white light was reaching up the river and he knew a police boat was on the way. At thirty miles an hour the craft dashed up the East River. The light swung shoreward until the watchman had to turn his back to shield his eyes from the glare. As he did so he saw a police emergency truck rushing down the path that had been followed to a fatal end by the first car; but it was the police boat that interested the watchman.

It was one of a fleet of eleven motor launches engaged, like the watchman, in guarding the harbor of New York City. Accidents, criminal depredations, fires, mutinies, explosions, piracies, all these may occur in that harbor, and they must be guarded against. For this job the city has, down the years, been developing two highly specialized branches of its police and fire departments. For the best of the men in these marine divisions, the harbor is something quite different from the flat surface of water seen by casual observers. They know literally every inch of the 578 miles of shore line. They know where it is deep and where shallow. Etched on their minds is knowledge of an infinite variety of things they never see. They are always conscious that there is more than water under the hulls of their swift boats. They are aware of every tunnel, submerged cable, sewer outlet, and hidden wreck. They know where the rum runners hide and the paths of ferries. Moreover, they know their job and do it.

That boat which came in response to the watchman's alarm was the *Sinco*, once the pleasure craft of a young multimillionaire, William B. Leeds, and given by him to the city for the use of the harbor police. It is sixty feet long and in its lockers are Thompson submachine guns, Winchester rifles, revolvers, and tear-gas bombs. But utensils for which there is more often a use are long hempen lines and grappling hooks. These were put over the side on this dark night at the beginning of a job that lasted thirty-six hours.

Back and forth they cruised while the grapples, like sharp pointed extensions of the policemen's arms, searched in the ooze of the river bottom for the vanished automobile. Finally near daylight some solid object was hooked and then lost as the tide, rushing seaward, put too great a strain on the line. Then a diver was lowered to the river bottom.

That diver was not a policeman. The city's divers are employees of the dock department and when needed are borrowed for police work. It was late in the afternoon before this man's reaching hands encountered the car more than 100 feet out in the stream from the point where it had plunged from the street. The first lines he fastened snapped. Two policemen in turn were dragged overboard from skiffs as they held stubbornly to lines against a sudden yank of the tidal currents. Fire department trucks trained big searchlights on that rippling, insecure stage of a city drama. All through another night they worked until



A fire boat fighting the flames that are threatening the destruction of a transatlantic steamship

and FLAMES

Ocean Port

at dawn the mud-encrusted car was deposited upright on the lighter deck.

As one of the rescuers opened a rear door of the car he saw, behind the wheel, the corpse of a city fireman, afterward identified as Martin Horan. Why he drove his car into the river is still a mystery.

The recovery of bodies from the harbor is a job which the harbor police confront day in and day out. Three hundred and eighty corpses were taken from the waters they patrol in 1931. The average never falls below one a day. It is unpleasant work but it must be done. Sometimes in their cruising they find these pitiful objects among the flotsam; more often, as in the case of this fireman, the recovery of bodies is the result of deliberate fishing.

Captain Henry Malley commands this force of three lieutenants, twelve sergeants, and 137 patrolmen that has grown out of a squad first organized in 1858. Originally they performed their duty in rowboats, arresting misbehaving sailors, quelling mutinies, and trying to prevent smuggling and the depredations of river pirates.

Now their fleet of eleven motor launches is, perhaps, the best in the harbor. The smallest is a twenty-two-footer which ambles along at ten miles an hour; all the others, ranging in size from thirty-five feet to sixty feet in length, are good for thirty miles an hour—or better when wind and tide are favorable. But it is the quality of the men that makes the organization what it is. They are picked men, most of them having had training as sailors or pilots. A score of them possess licenses qualifying them to pilot big ships in and out of the harbor.

Flying a little triangle of green inscribed with "Police" in white letters, these boats are almost constantly on patrol. Starting from the Battery, one of them commonly circumnavigates Manhattan Island in about two hours and a half. The trip would occupy less time but for the necessity of coming inshore at frequent intervals to report to precinct headquarters. They never know whether their orders will be to proceed to the scene of a fire, a wreck, a mutiny, a piracy, or the reception of a king.

All of the distinguished persons arriving in the country through New York harbor and whom the city receives officially are conducted ashore under the auspices of the harbor police.

Above, the great pumps of the *John Harvey*, newest and most powerful fire boat, raise a wall of water. Left, harbor policeman grappling to recover a body

All the men of the harbor police are expert swimmers, trained in life-saving methods. When an insane man escaped from a city hospital and clambered to the top of the arch of Hell Gate Bridge, this became a job for the harbor police. From the topmost girder the crazy man gibbered at Sergeant Sweeney and his men tossing in their launch far below. As the launch headed for shore the Sergeant looked at Patrolman Saeger, who was once an ironworker. Saeger took off his coat and proceeded to climb after the madman, who left his perch and clambered away like a chimpanzee. From beam to beam this dizzy game continued until at last the only way the crazy man could escape was by jumping—and he was not crazy enough for that. Saeger collared him then and by cajolery induced his captive to descend to the floor of the bridge. It was not until later that Patrolman Saeger learned that the maniac, also, was a former ironworker.

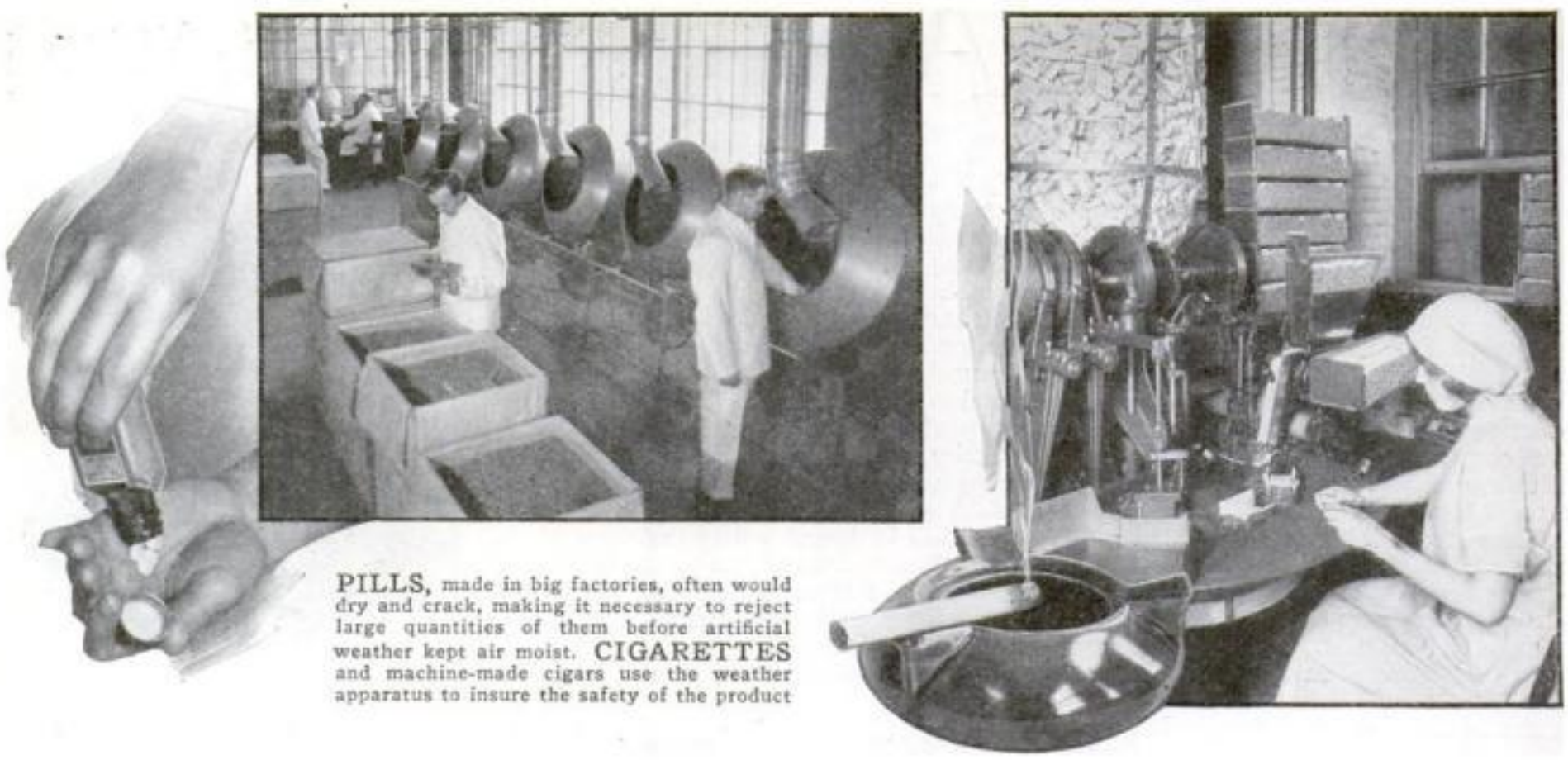
Last year five men of the harbor police received medals for rescues of drowning persons.

When the Clyde-Mallory liner *Neches* sank in the harbor some time ago after striking a barge, the members of the crew were rescued by the police boats in record time. Twenty minutes after the collision the ship sank, but the police had saved her entire company.

In these dull times the police have an extraordinary problem in keeping order among the restless, bored crews of ships loafing in the harbor for want of cargoes. Steamers from *(Continued on page 120)*

Hose tower of a modern fire boat, from which water was thrown over the George Washington bridge, which spans the Hudson River at a height of 213 feet

Many Industries, Unable to Meet Losses Caused by Sudden Changes in Condition of Air,



PILLS, made in big factories, often would dry and crack, making it necessary to reject large quantities of them before artificial weather kept air moist. CIGARETTES and machine-made cigars use the weather apparatus to insure the safety of the product

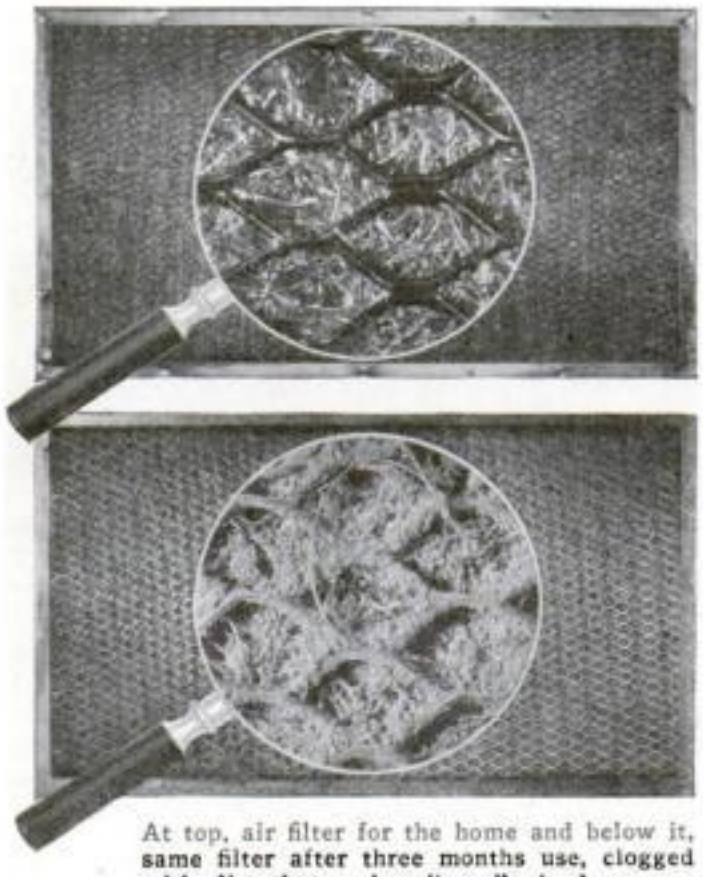
Man-Made WEATHER *bans*

Air-Conditioning Plants, Developed for Factories, Will Soon Guard Homes from Dust and Bacteria

ARCTIC cold, tropic heat, fresh May mildness in a sweltering July, warm and moist indoor air when the mercury outdoors has dropped below zero, are only a few of the conditions of climate now made to order by the new science of manufactured weather.

Made-to-order weather is now an indispensable part of more than 200 different types of industries. It has made possible the modern broadcasting studio, as well as the sound-tight and air-tight "talkie" studio. Hospital rooms, supplied with controlled air, have saved premature infants; and, with oxygen added to the atmosphere, have helped the recovery of pneumonia patients.

Air artificially cooled and dried in summer and heated and moistened in winter affords year-round comfort in theaters, offices, banks, restaurants, department stores, and public buildings. Trains with conditioned air have just been put into service on one great railroad.



At top, air filter for the home and below it, same filter after three months use, clogged with dirt that makes "pure" air dangerous

In the windowless Travel and Transport building of the 1933 World's Fair at Chicago, in a large section of New York's "Radio City," and in the million-and-a-half-dollar windowless factory of the Simonds Saw and Steel Company, at Fitchburg, Mass., now nearing completion, air-conditioning machinery will provide the entirely inclosed interiors with comfortably tempered air, freer from dust and bacteria, and generally more healthful, than the purest "pure air" encountered anywhere *outdoors* in the modern city!

Perhaps even more interesting to many readers than the knowledge that manufactured weather has been put to scores of extraordinary industrial uses is the news that small air-conditioning plants, capable of maintaining an ideal temperature and humidity relationship throughout all the weather vagaries of both summer and winter, may soon be made available for the average American home.

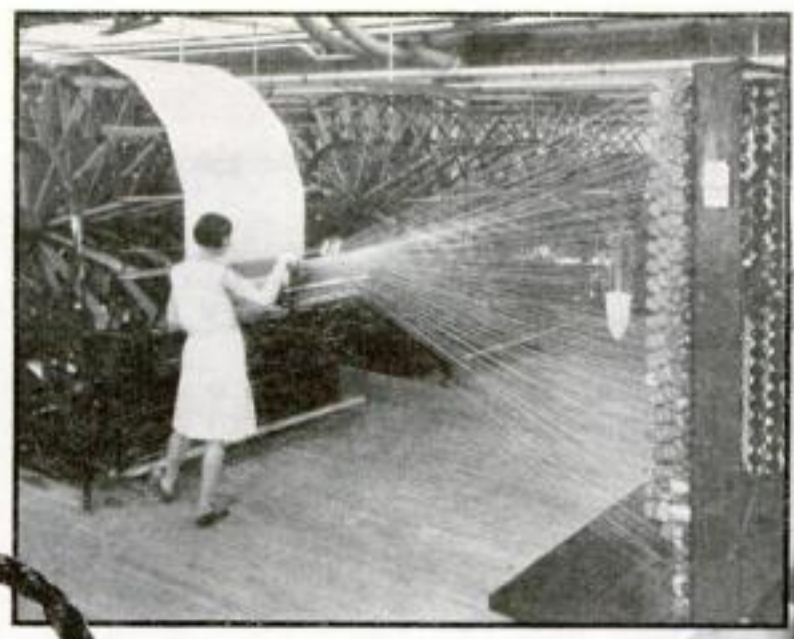
A number of home plants for filtering, heating, moistening, and circulating the winter air are now in use. A few have been equipped with refrigeration for cooling, as well. When the engineers, still working on the problem, succeed in producing a safe, efficient, and entirely automatic refrigerating unit, at a price within the means of the average home-owner, summer cooling and dehumidifying may be universally accomplished at a cost probably no greater than winter heating.

With complete air-conditioning apparatus in the home, broiling August sun will mean as little as piercing January cold; every day indoors will be a fine day!

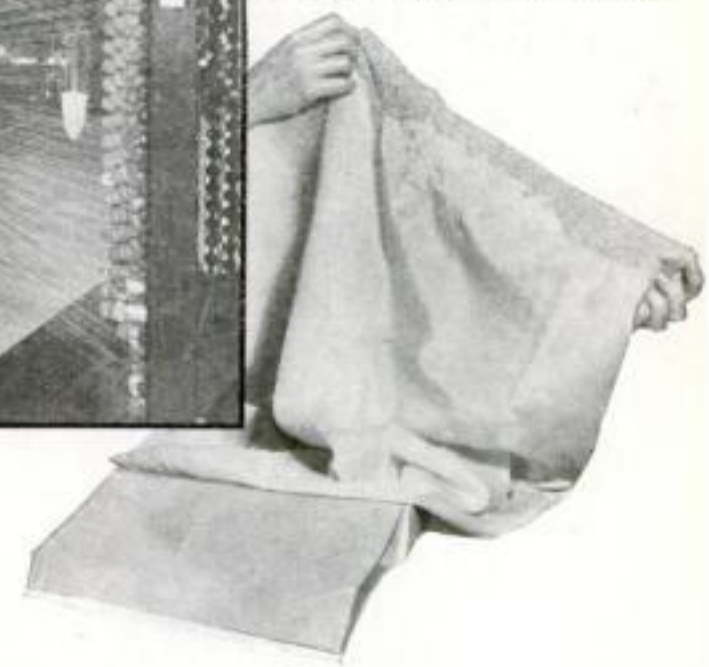
THIS modern science, which has revolutionized many old industries and helped create new and which now promises to be one of the most important contributions to human health and comfort in the history of invention, is a technical triumph won almost entirely within the last thirty years, and particularly during the last ten.

To be completely "conditioned," air must be cleansed, controlled in temperature and humidity, and circulated uniformly. Willis H. Carrier, an engineer who has won international recognition for his contributions to the art of weather making, formulated this fundamental principle as early as 1901. By continuous control of all four factors, air-conditioning is differentiated from heating, ventilating, cooling, filtering, or humidifying.

Operate Successfully When Machines Give Accurate Control of Temperature and Humidity



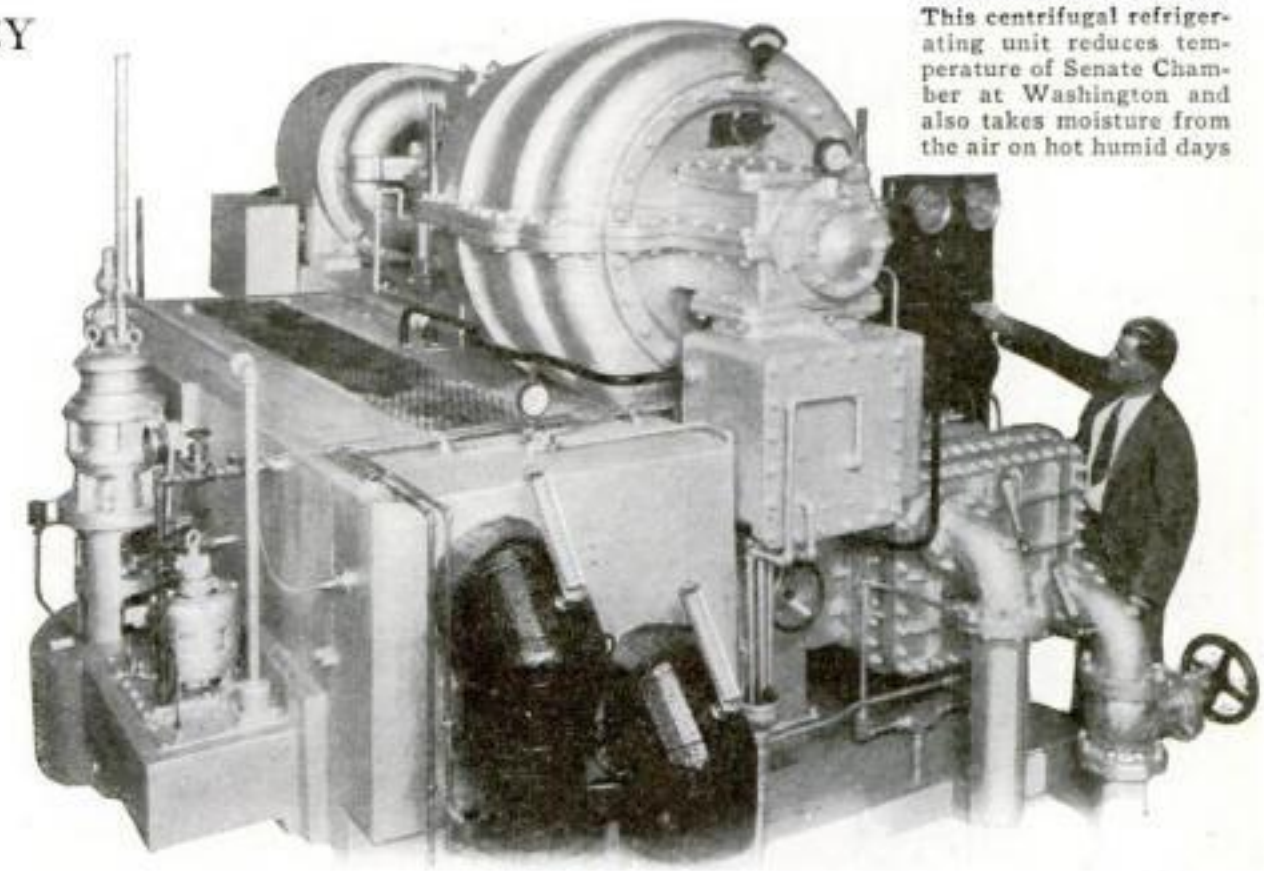
RAYON, chemically made silklike material that can be manufactured only where there is full control of the air's temperature and humidity, a condition secured by artificial weather machine



CANDY packing, left, needs cool, dry air obtained with weather machine to keep chocolates from losing their form and becoming streaked

Winter Cold, Summer Heat

By KENNETH M. SWEZEY



This centrifugal refrigerating unit reduces temperature of Senate Chamber at Washington and also takes moisture from the air on hot humid days

Previous to the pioneering work of Carrier, air had been regarded chiefly as a *heat*-carrying medium, and attempts to regulate indoor climate in the face of an outdoor climate which changed constantly were centered almost entirely in altering the *temperature*. Carrier insisted that air must also be regarded in the light of its *moisture* content, since moisture is more important to comfort and to the special demands of industry than the degree of temperature.

WITH precisely the same temperature (say seventy-five degrees Fahrenheit) we may have a "hot and depressing" summer day, the overheated, dried-out, midwinter atmosphere of an average office building, or the refreshing air of a spring day. The relative humidity, or the amount of moisture in the air compared with what it can hold, makes the difference.

Not so obvious to the layman as the effect upon his personal comfort is the effect of indoor weather conditions upon industrial operations. Yet industry, and not human comfort, made the first demand upon scientific air-conditioning.

Textile and paper mills, printing plants, candy factories, bakeries, powder mills, food preserving and storage plants, furniture factories, and scores of other industrial enterprises that worked with hygroscopic, or moisture-absorbing, materials had long been victimized by the tantrums of unregulated weather.

The first complete weather-making units were installed in the spinning and weaving rooms of textile mills. In the normally dry, dust-laden air, superheated by a maze of whirring machinery, the fibers of cotton or wool lost a valuable part of their natural moisture, becoming weaker, brittle, less pliable, and less satisfactory for further processing. Besides the interference with production caused by breaking of threads, shut-downs, and an inferior product, the material lost considerable weight during the manufacturing, with the result that when material was bought by weight and sold by weight, a considerable part of the profit evaporated in thin air.

To keep down these losses, textile manufacturers resorted to the more or less haphazard methods of wetting the floors, distributing steam pots among the machines, and spraying water vapor directly into the air.

Weather-making machinery, which filtered the air as it came from outdoors, sucked it through dense sprays of water to give it the required additional moisture, heated it when too cold, and by an elaborate duct system distributed it evenly throughout the mill, solved the problem with a satisfaction never before dreamed of by the mill operators.

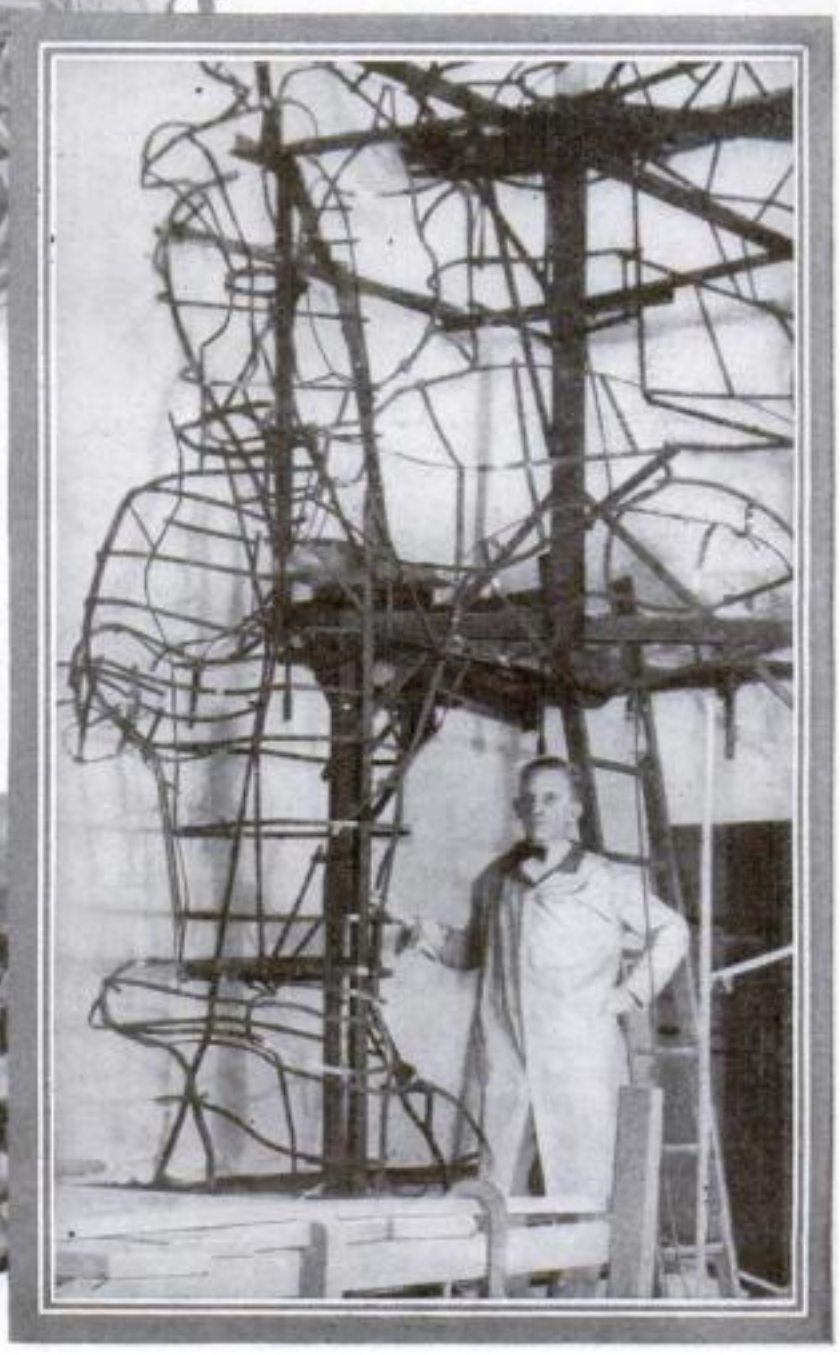
Printing *(Continued on page 121)*

Marvels *of the* Deep *shown*

A derrick, mounted on pontoons, was used to raise the heavy piece of coral, below, from the ocean depth off the Bahamas. It is now on exhibition at American Museum of Natural History

Wearing diving suits, men went down to the ocean's floor, selected coral specimens, and tied a rope to them so they could be hauled up

Below, a portion of the naked steel work, weighing ten tons, around which the coral is mounted. The shape of the frame was necessary to support the topheavy pattern of the branching coral



Dr. Roy Waldo Miner, curator, right, studying the model of an underwater scene reconstructed from diver's observations and made as guide to accurate mounting of museum group. Colors of fish were painted on the spot to get them just right

At right, close-up of one of the exhibit's unique specimens—a mass of beautiful finger coral

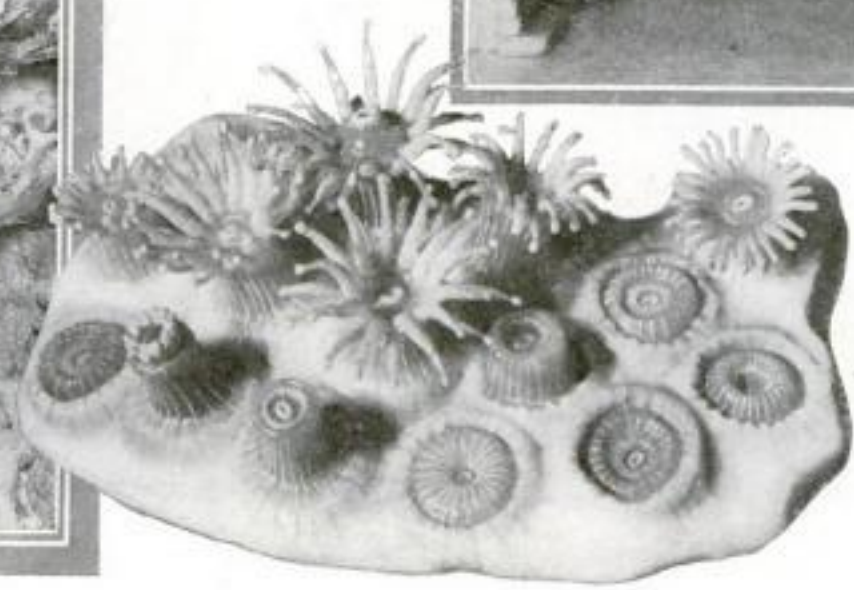
in Amazing Museum Exhibit

MERELY by walking down a flight of stairs, a visitor to the American Museum of Natural History, New York, may soon experience the sensation of donning a diver's helmet and exploring the wonders of the sea bottom. Paintings on the upper floor of the Museum's two-story Hall of Ocean Life, nearing completion after ten years of labor and the expenditure of $100,000, have been executed to give a realistic imitation of sea scenes. A descent to the lower floor is like stepping through the picture. Beneath each painting is a submarine exhibit. This new idea in marine groups was conceived and executed by the Museum's Curator of Marine Life, Dr. Roy Waldo Miner. How the coral was taken from the sea bottom, transported to the museum and mounted is shown here, in photographs made especially for POPULAR SCIENCE MONTHLY.

Upper left, an enlarged section of brain coral, which shows how it gets its name. Above, two-ton mass of the brain coral being swung into place for the Museum's Hall of Ocean Life exhibit

Below, a completed corner of the coral group built up around the intricate steel framework shown on opposite page. The bracing to support this exhibit was worked out with precision used in designing a bridge

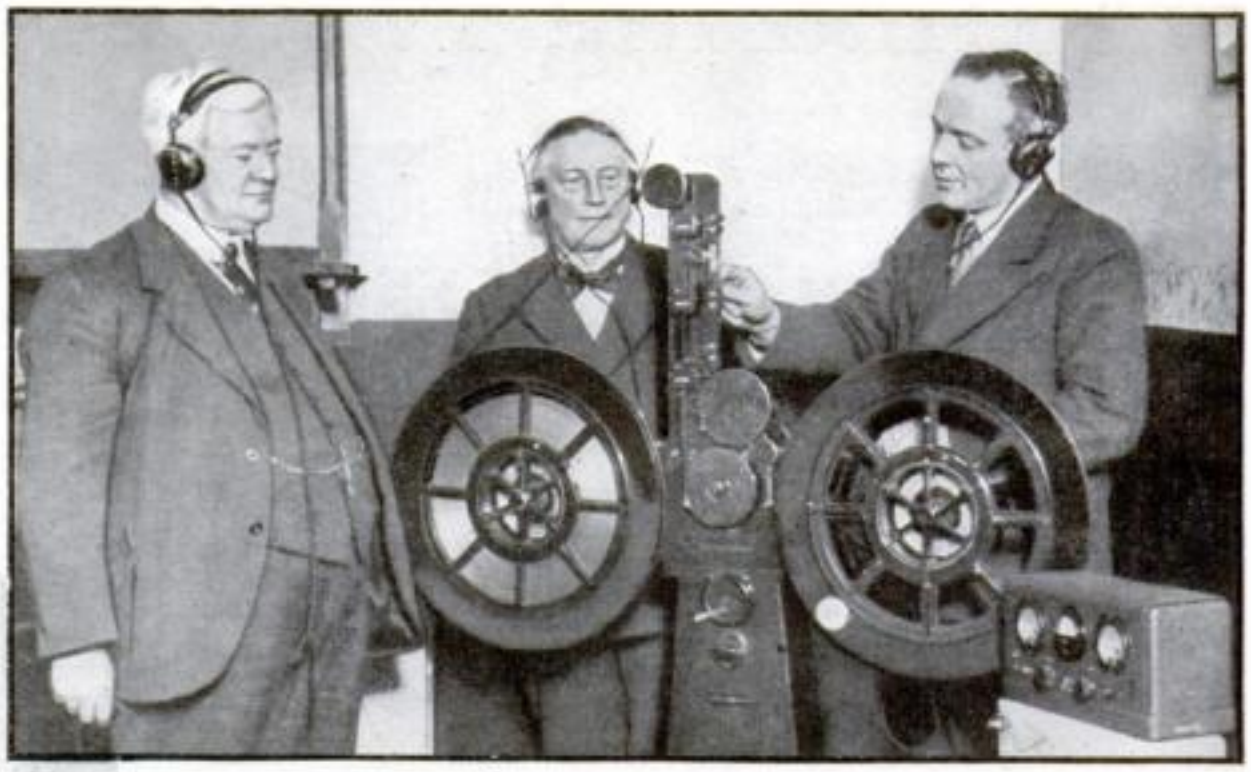
Above, to give the exhibit realism, a panorama of an ocean scene was painted in upper hall. It will be illuminated so that the illusion will be further heightened. At right, panorama above and undersea specimens arranged on floor beneath it



At left, model shows what coral animals, builders of innumerable islands, look like when they are magnified hundreds of times. They change sea salt to limestone, which forms colored coral

Talking Tape Ousts Court Stenographer in British Test

THE fallibility of human stenographers may trouble British law courts no longer, since a recent test of a sound recording device known as a "talking tape" to receive the evidence developed during a hearing at Manchester. When the proceeding was over, the metal tape bearing the sound record was played back to the judges. The sound is registered upon the metal by a process of magnetization, which is said to give a faithful reproduction of speakers' tones. Moreover, the device easily keeps up with rapid talkers.



Sound recording device, known as "talking tape," made record of evidence in British court. Above, tape is repeating proceedings while judges listen in

Big magnolia tree moved to make way for road in park

MAGNOLIA TREE MOVED BY HAND

BECAUSE it stood squarely in the path of a projected road through a Washington, D. C., park, a big full grown magnolia tree recently took an unusual journey. Rather than cut it down, Government officials set a hundred men at the task of moving it. Powerful jacks raised the roots, with a protecting parcel of earth, so that the whole could be placed upon rollers. When two trucks failed to budge the mass, the levers were used to force it along by hand, fifty feet a day, toward its new home.

CHILD CAN LIFT PIANO

A CHILD can lift a piano with the aid of a new jack invented for the purpose and recently patented by an Abilene, Kans., piano tuner. It lifts the heavy instrument so the floor underneath may be cleaned. Housewives might also find the invention useful for raising beds and other weighty pieces of furniture.

DRAWBRIDGE OPENS FOR HOUSE ON SCOW

MANY a strange craft has passed beneath the Fremont drawbridge, near Seattle, Wash., but the towerman must have rubbed his eyes the other day when he saw a house approaching on a scow. Nevertheless he swung the draw open for the unusual cargo, and for another just like it that soon followed. The two dwellings had been purchased by C. C. Casad, a city engineer, in Seattle. He owned two vacant lots in Bremerton, twelve miles across Puget Sound, so he loaded the houses on scows and ferried them across. From the dock tractors moved them to their new site.

Two houses were loaded onto scows and moved across Puget Sound. Photo shows drawbridge open to let strange cargo pass

SIZE GIVEN ON DIAL OF NEW TAPE

EASY to read at a glance is a new dial tape measure. When it is unrolled to the length of the object measured, the dimensions are instantly shown on the indicating face. The small hand registers feet and the large one inches. Three sizes from twelve to a hundred feet are made.

Hands tell dimensions in new tape measure

NEW MACHINE CUTS STEPS IN HILLSIDE

This terracing machine is used to cut steps in hillsides to check flow of water and reduce loss due to heavy erosion

RECENTLY in Texas a machine was demonstrated that cuts steps in hillsides. Where hillsides are not terraced in some such manner, swiftly flowing water carries away much fertile soil. The new terracing machine, in appearance and operation, is similar to a road scraper. Steps are formed by the shape of its blade and the manner in which it is hung. United States Department of Agriculture engineers, who helped design the terracing machine, estimate that the annual loss to farmers caused by water draining off hillsides is approximately $200,000,000.

DIVERS' SPRINGBOARD IS ADJUSTABLE

WHEN world diving stars vie for honors at the coming Olympic Games in California, none will be able to say that the springboard is too limber or too stiff. An adjustable board, the invention of a San Francisco amateur swimmer, will be used. The point of support, or fulcrum, may be moved by hand or by electric motors to a place that suits the individual's weight. The inventor took his idea from a rolling pin, which the fulcrum resembles.

Olympic diving aspirant demonstrates the use of an easily adjustable springboard

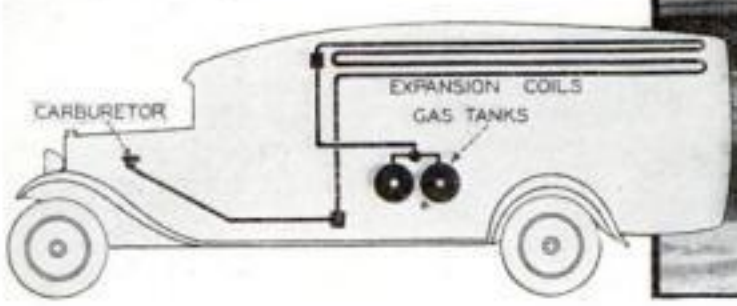
FUEL GAS COOLS TRUCK AND RUNS ITS MOTOR

A REMARKABLE new type of refrigerated truck for delivering perishable products, such as meats and butter, makes the refrigerant do double duty. After it cools the body of the truck, it runs the engine, taking the place of gasoline.

The refrigerant, a new fuel gas perfected by a large oil company, is compressed to liquid form and carried aboard the truck in tanks no larger than standard gasoline tanks. Allowed to escape into pipe coils in the back of the truck, it chills the surrounding air as much as necessary, down to freezing temperature or even lower, if desired. From the cooling coils the gas is led to the motor, where it serves as fuel.

According to the engineers who perfected the method, it might also be applied to motor buses operating in hot climates and to pleasure yachts.

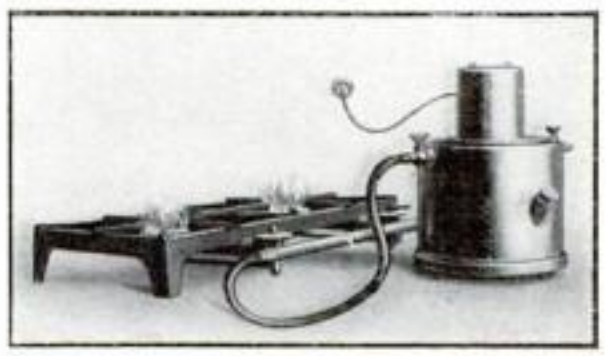
Drawing below shows expansion coils in refrigerator truck and pipe to the carburetor. Right, truck cooled with compressed liquid that also runs the motor



Dummy fox hunter is mounted in tree to keep foxes from an English farmer's livestock

SCARECROW IN TREE KEEPS FOXES AWAY

WHEN foxes made repeated inroads upon his livestock, an English farmer devised an innovation in "scarecrows." He placed a dummy fox-hunter, properly outfitted in riding costume, atop a small tree where it is plainly visible in all directions. So realistically posed is the figure, as seen in the photograph, that at a distance or in twilight it might be taken for a real hunter. Now the farmer hopes that it will frighten away foxes as well as birds.



TURNS GASOLINE TO COOKING GAS

COOKING gas for the household range is manufactured economically from gasoline by an ingenious electric device invented in Germany. Fuel is poured into a cylindrical tank through a filler tube, and an electric cord is plugged into the nearest socket. At the turn of a switch, a four-bladed propeller revolves at high speed in the tank. A current of air is sucked in at the top and mixed with a fine mist of gasoline spray, forming a gas of high fuel value that may be drawn off through a valve as needed.

Strange Instrument Built to Solve Mystery of

Remarkable Radiations from Remote Source Lead to World-Wide Investigation

Dr. W. F. G. Swann, designer of the cosmic ray telescopelike instrument, is seen reading the recording device in his laboratory at Philadelphia

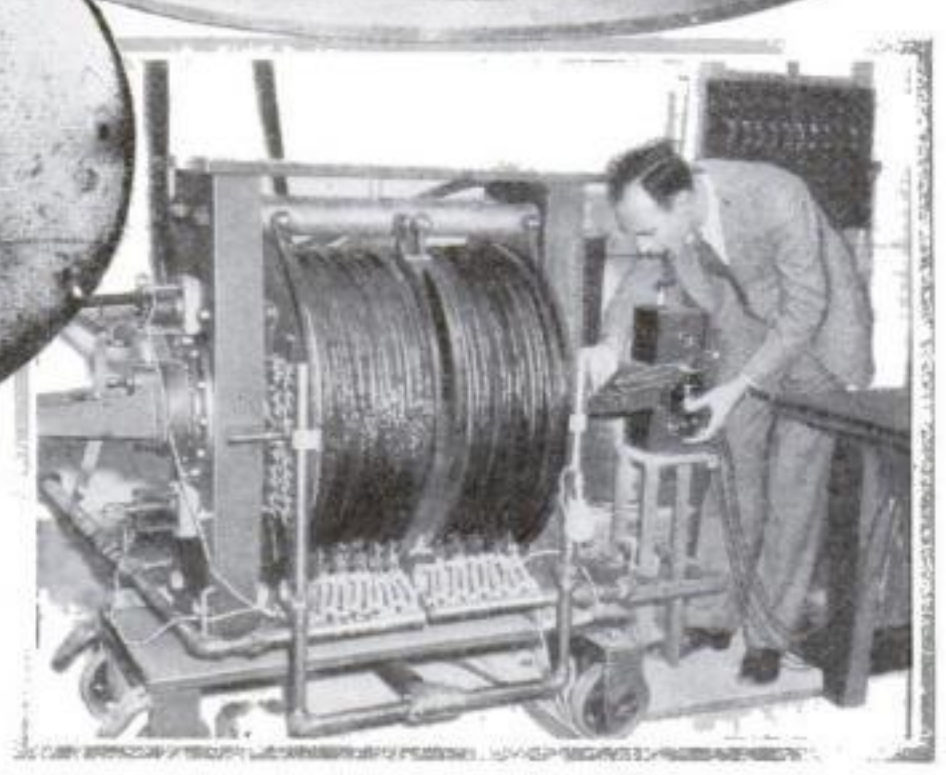
Nicknamed the "cosmic ray telescope," the giant direction finder at left uses electrical instruments to determinesource of the mysterious rays that bombard earth

THE world's first "cosmic ray telescope" shortly will scan the heavens from the roof of a Swarthmore, Pa., laboratory. Its users seek the source of the mysterious rays from outer space which bombard the earth with such force that only a fifty-foot wall of lead will stop them.

This announcement heads a list of new developments that may explain the rays and put them to practical use, nearly ten years after their discovery.

In the first world-wide exploring project of its kind, more than a dozen scientists, assisting Dr. Arthur Compton, University of Chicago physicist, will go this spring and summer to such widely separated points as Alaska, Panama, Kashmir, Singapore, South Africa, and Australia to measure the strength of the rays. Dr. Robert A. Millikan, America's pioneer investigator of cosmic rays, will send free instrument-carrying balloons ten miles high to study them.

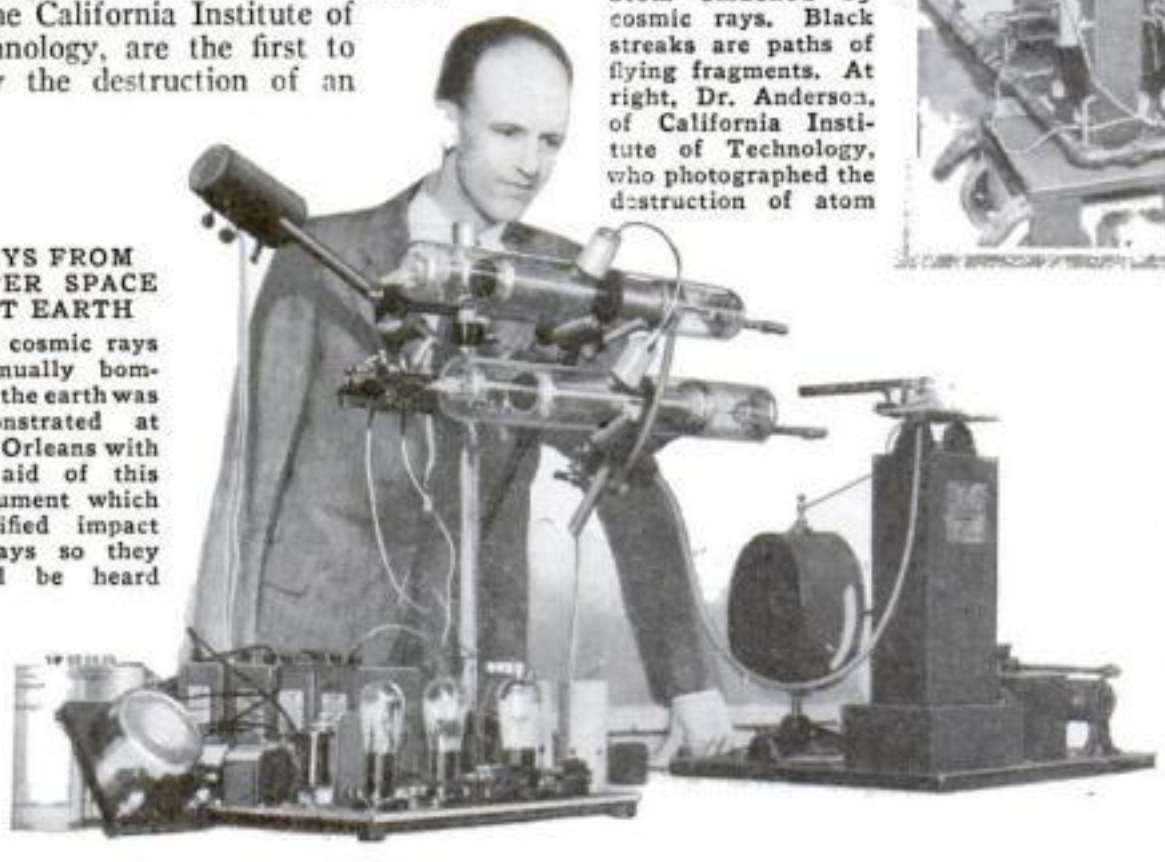
Eleven photographs, made not long ago by Dr. Carl A. Anderson of the California Institute of Technology, are the first to show the destruction of an atom by cosmic rays. They also measure the energy released, which may attain the staggering figure of 300,000,000 volts. For this measurement a powerful magnet acted as a brake on the flying atom fragments, which were made visible by trails of water vapor condensed along their paths.



One of the eleven photos that show the atom smashed by cosmic rays. Black streaks are paths of flying fragments. At right, Dr. Anderson, of California Institute of Technology, who photographed the destruction of atom

RAYS FROM OUTER SPACE HIT EARTH

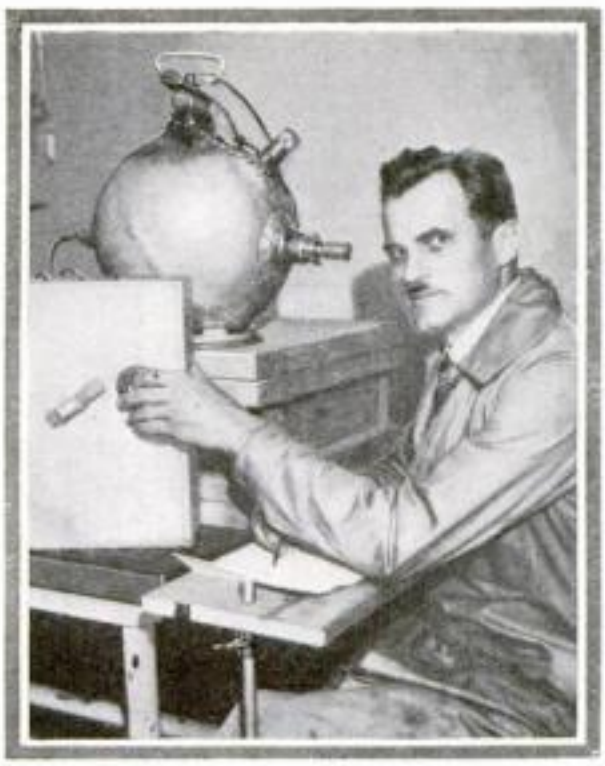
How cosmic rays continually bombard the earth was demonstrated at New Orleans with the aid of this instrument which amplified impact of rays so they could be heard



A theory that cosmic rays influence life process of plants is being investigated by United States Department of Agriculture experts. Experiments also indicate that cosmic rays have a part in forming the Heaviside layer of the earth's atmosphere, which affects radio broadcasting, and that they may assist in weather forecasting.

What are cosmic rays? Dr. Millikan holds

Cosmic Rays



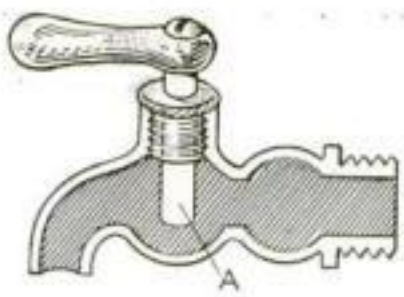
Dr. Arthur Compton, University of Chicago physicist, will head corps of scientists in study of cosmic rays, using this electroscope, which measures their strength

to his theory, said to be strengthened by the Anderson photos, that they are waves like light and X-rays. They come, he believes, from the dark spaces between distant galaxies of stars, and are by-products of the birth of new atoms throughout space—showing, in his opinion, that the universe is not running down. But some European scientists suggest the Milky Way as the possible source of the rays. In this case they ought to come from a restricted part of the sky. Repeated tests made at all hours by sinking electroscopes, the only instruments that will detect the invisible rays, in the waters of mountain lakes, have so far seemed to show the cosmic rays uniformly strong from every angle.

Tests with the new "cosmic ray telescope" may prove equally conclusive, according to its designer, Dr. W. F. G. Swann, director of the Bartol Research Foundation of the Franklin Institute, Philadelphia. Simply by swinging it across the sky, an observer can discover any point from which the rays come more strongly than another.

The telescope has neither mirrors nor lenses, since they would have no effect on the rays. Instead, its seven-foot barrel is tipped by two steel chambers containing nitrogen gas under high pressure. Cosmic rays make this gas a conductor of electricity, and their presence and strength may thus be detected with recording instruments. When the rays fall equally strongly upon both chambers, the telescope is so wired that the effects balance and produce no reading. But if the telescope is pointed toward a strong source of the rays, the near chamber will be more strongly affected than the far one, which is partially shielded by millstonelike blocks of lead, and a telltale reading results.

Other uses are foreseen for the unique instrument. Trained on a cloud, it measures the absorption of cosmic rays by water vapor. Metals such as copper may be substituted for the lead "millstones" for comparing their ability to transmit the rays.



Can You Invent It?

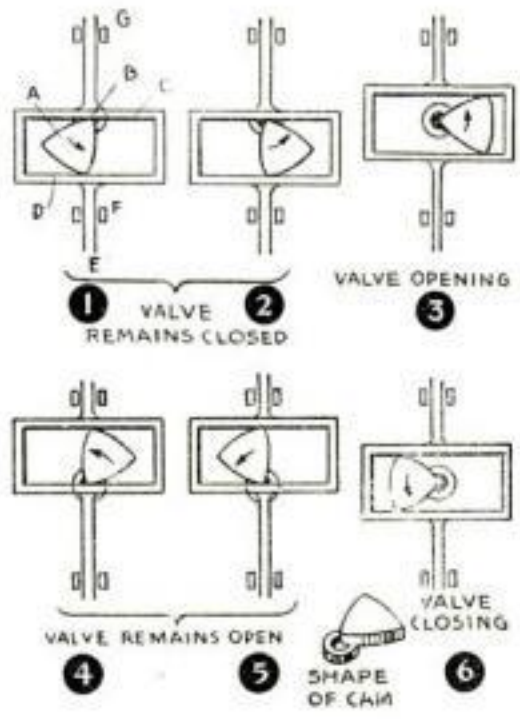
HERE is an incomplete water faucet. How would you complete its mechanism so that no spring will be required to close it or keep it closed? You are free to modify the part A in any way you choose, and you also may add a single additional part.

* * * * *

The six diagrams below give the solution of the cam-movement problem of last month in which a valve was to be closed and opened.

The problem is solved by using a triangular cam whose sides are arcs of circles, each described from the opposite angle, the distance between the parallel bars being equal to the radius of the circular arcs forming the sides of the cam. The cam A is set on the shaft B so that one corner is in line with its axis.

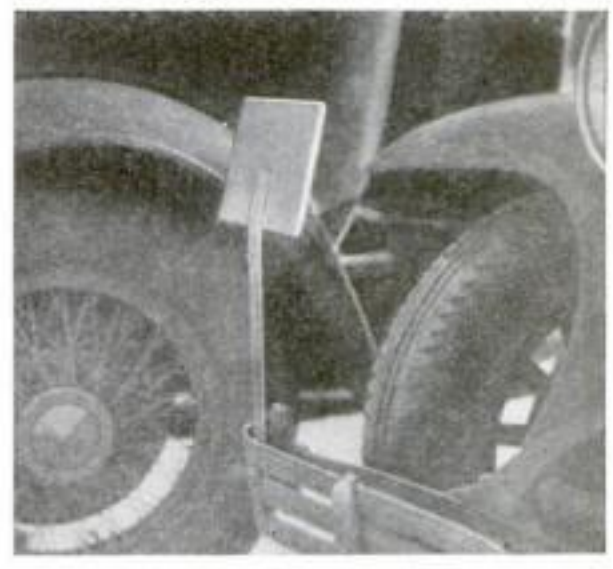
During the shaft's rotation from position 1 to 2 the curved face of the cam opposite the axis merely slides upon the lower bar D without moving it. During the rotation from position 2 to 4 the cam lifts the bars and rod, opening the valve, which remains open while the face of the cam again slides along the bar C through positions 4 and 5. The "closing" motion is then effected while the cam revolves from position 5, through 6, back to 1.



SAILBOAT FOLDS UP

Above, forty-pound boat ready for use and at the right, same boat folded compactly for carrying

ESPECIALLY designed for campers is a folding sailboat recently placed on the market. Stored for carrying, it makes a compact bundle weighing only forty pounds, easy to transport by train, on an automobile luggage rack, or carried on the back. According to the maker, it may be assembled in ten minutes. There are few streams that would be too shallow for the boat; so light is its construction that it draws but four inches of water.

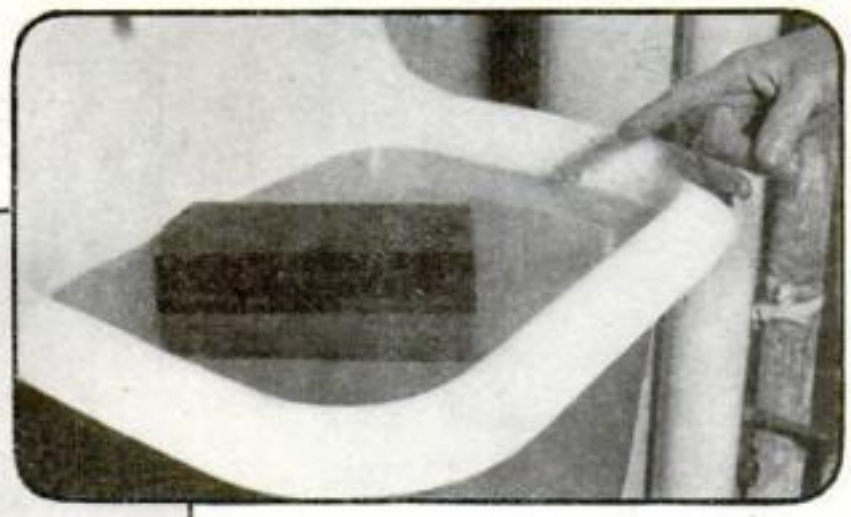


MIRROR AIDS PARKING

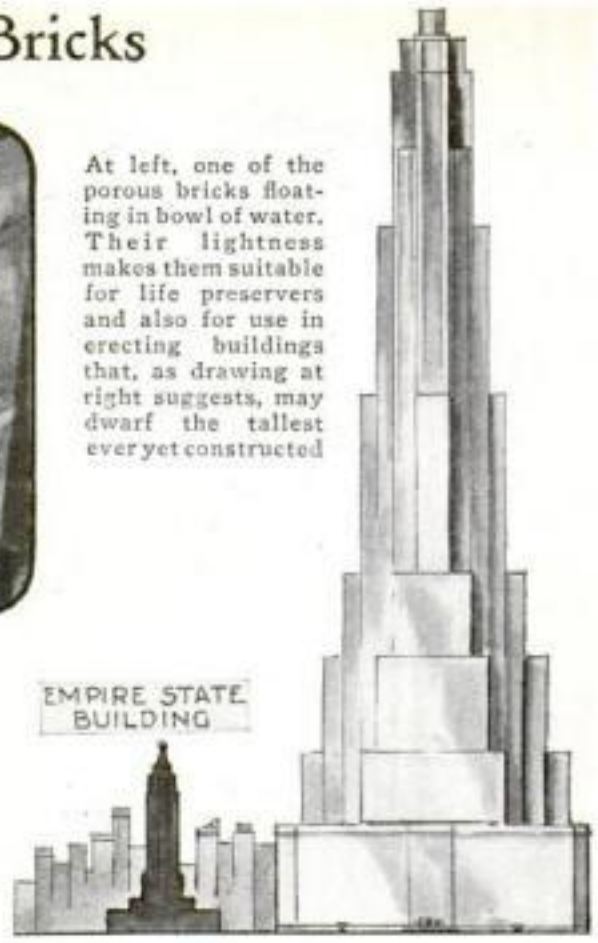
WITH a new "parking mirror" installed on his right fender, a motorist can see just how near the curb his front wheels are. In a tight place, he can also avoid grazing the car in front in getting in or out of a small parking space.

Mile-High Buildings Possible with New Bricks

Below, Dr. Charles F. Burgess, distinguished chemist, and one of his new bricks with which skyscrapers a mile high may be built

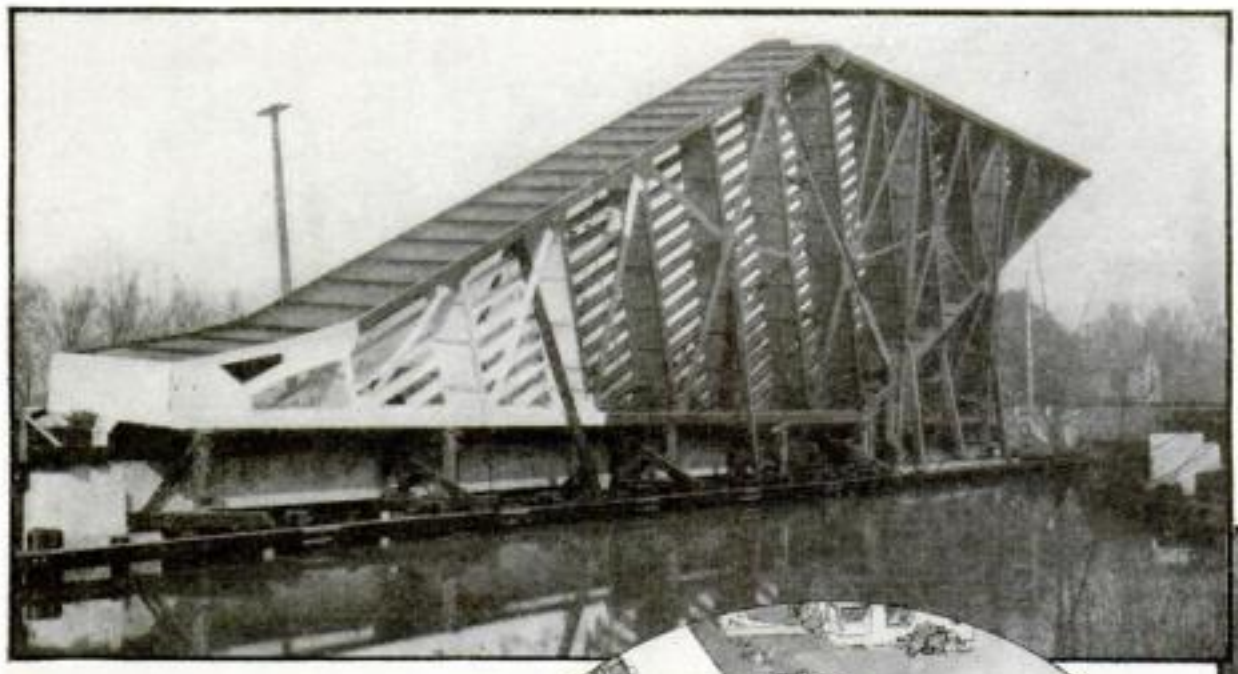


At left, one of the porous bricks floating in bowl of water. Their lightness makes them suitable for life preservers and also for use in erecting buildings that, as drawing at right suggests, may dwarf the tallest ever yet constructed



BUILDINGS a mile high are made possible, engineers say, by the invention of a brick so light that it will float in water. It is the latest accomplishment of Dr. Charles F. Burgess, one of the nation's most distinguished chemists, who recently received the coveted Perkin medal for achievement in that field. A bricklayer can set six of the new "floating bricks," it is said, in the time he requires to lay one of the conventional type. Despite their light weight the bricks have the necessary structural strength to build towers five times as high as the Empire State Building. They are made from ordinary clay, and require but twelve hours, instead of the usual three weeks, to manufacture. Any desired shape may be produced and the bricks may even be sawed. Because of their high heat-insulating value they are declared especially adapted to modern construction. The bricks are waterproof.

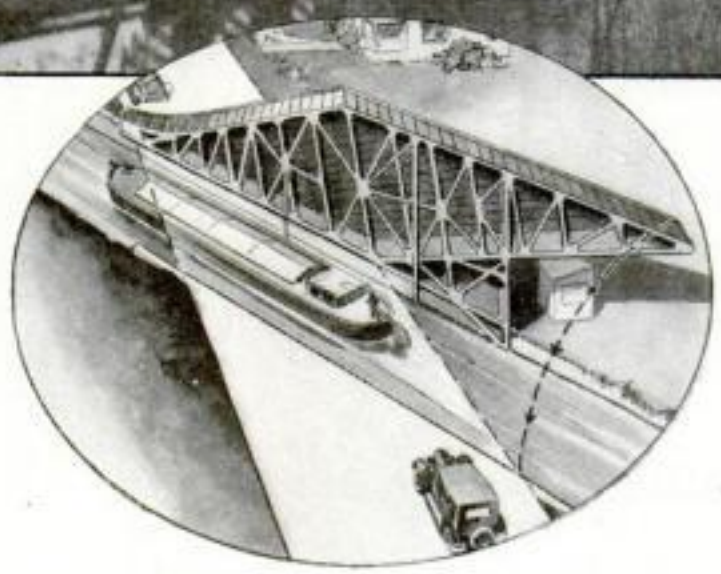
Another amazing utilization is foreseen for the new product. Life preservers of brick are now practical, it is declared, since the porous, floating clay is admirably adapted to this purpose.



CRAZIEST BRIDGE SPANS CANAL

TO ELIMINATE dangerous curves in a New Jersey state highway at a point where it crosses a canal, engineers have built what is called the craziest bridge in the world. Its unusual diamond-shaped construction is made necessary by the fact that the new road crosses the canal at an extreme slant.

As seen in the photograph above, the entire back of this lift bridge is the roadway. The bridge is seen in the "open" position. Hinging on one long edge, it swings downward to occupy the position shown by the dotted lines in the accompanying drawing. At this point the canal is twenty-eight feet wide, and the roadway is forty feet wide. A gasoline engine raises the bridge.



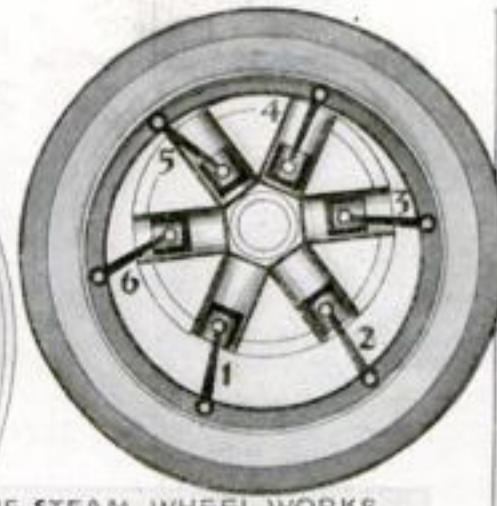
At top, strangest bridge in the world when open. In oval, drawing shows how it swings into place

MOTOR BIKES RIDE RAILS THROUGH SIAM SWAMP

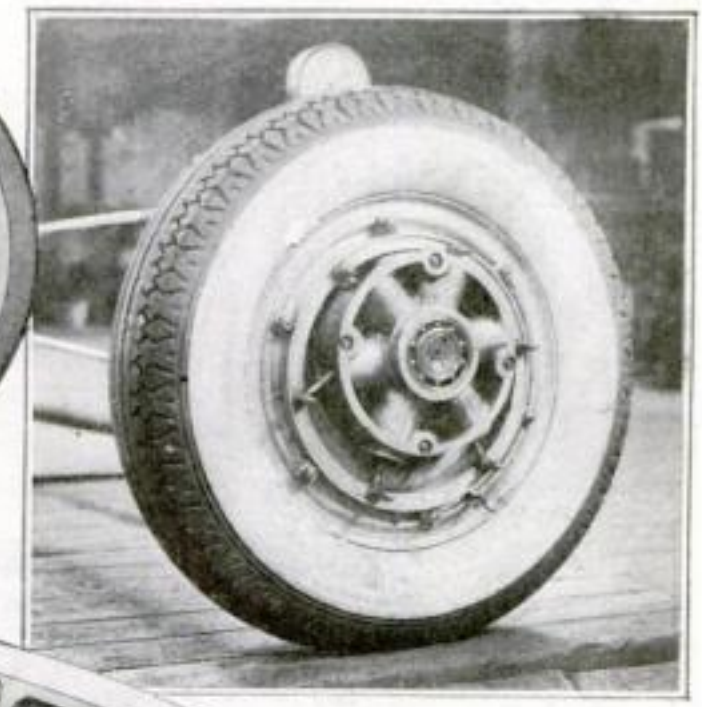
WHEN depression struck the Far East, two British planters started overland for London on a pair of motorcycles. As far as the Siamese frontier, they experienced no difficulty. In Siam, the muddy roads were impassable and the cyclists were stopped until a machinist at a local tin mine came to their rescue. With wheels from a hand-car, he converted the motorcycles into miniature railroad trains, upon which they rode the rails of the Siamese National Railways.

Siam's roads stopped these motorcyclists until they put car wheels on the bikes and rode rails

Each Wheel an Engine in New Cars



HOW THE STEAM WHEEL WORKS. PISTON RODS DESCEND ONE AFTER ANOTHER LIKE THE FEET OF THE MAN IN THE TREADMILL, ROLLING WHEEL FORWARD



Working model of a steam wheel for autos being tested in laboratory at Chicago

Principle of Steam Wheel on Autos and Uses to Which Idea May Be Put

INDEPENDENTLY-MOUNTED STEAM WHEELS WOULD GIVE A CAR ADEQUATE TRACTION OVER THE ROUGHEST TERRAIN

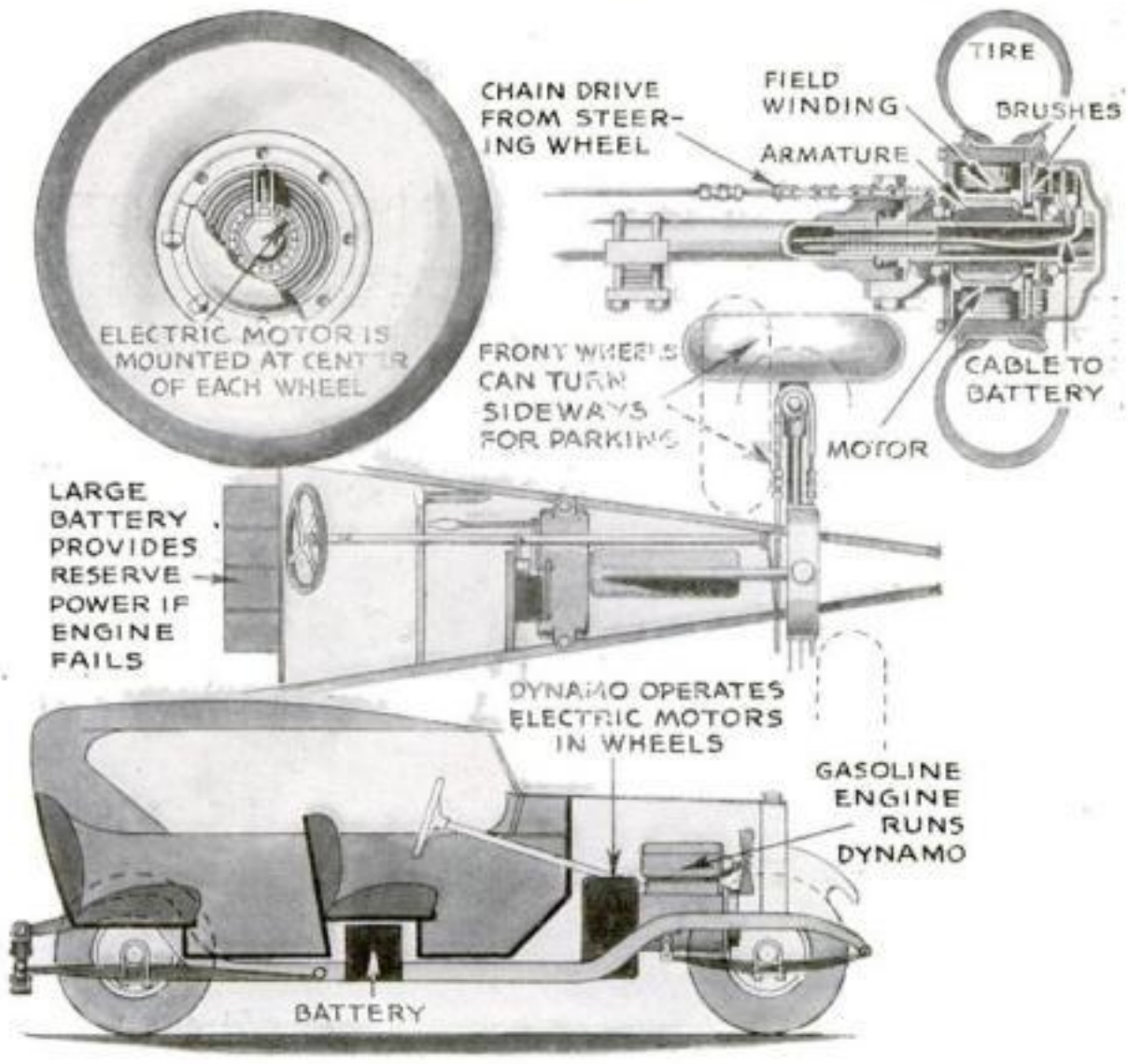
A HIGH-SPEED BUS WITH EIGHT STEAM WHEELS

WILL automobiles of the future carry their motors in their wheels? Inventors say such a scheme of "unit power" would lead to marked advantages in traction, efficiency, and ease of control. One proposes steam-driven wheels for motor cars. Another has designed a car using electric wheels.

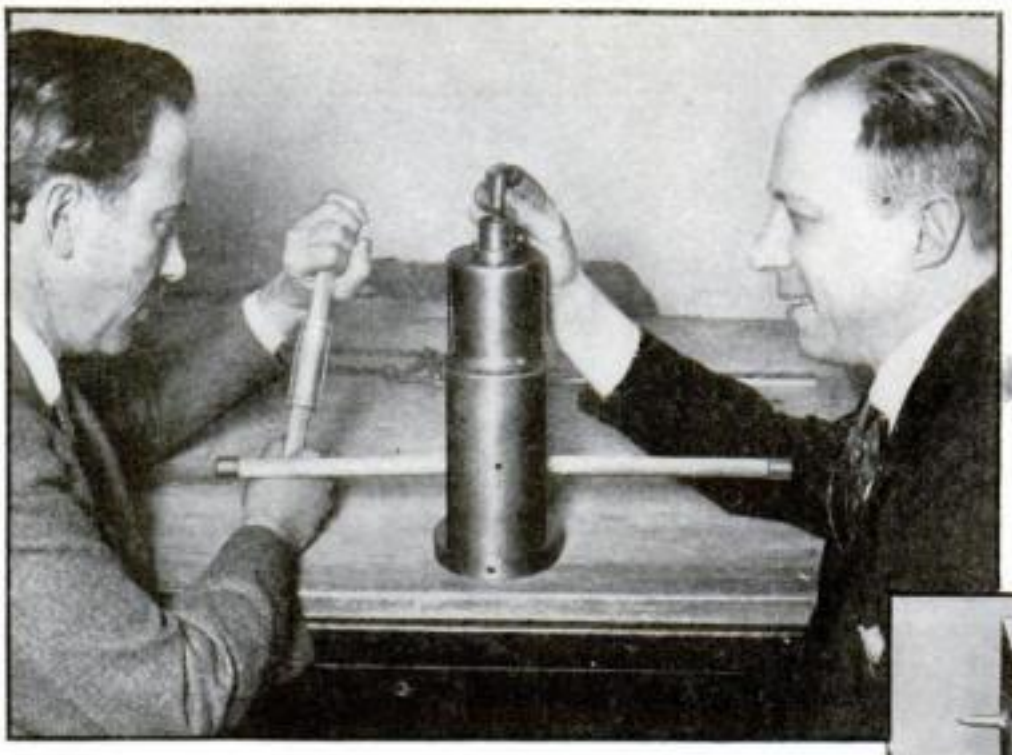
A working model of the steam wheel now runs in circles at the end of an eighteen-foot arm in the Chicago laboratory where it is being perfected. It contains a six-cylinder engine fed with steam through the hub, and mounted eccentrically to the wheel proper. The latter would be linked to the axle of an automobile so that it could revolve freely. How the steam turns the wheel is shown above. A car equipped with a boiler to generate steam and with such wheels, according to the inventor, could speed at 100 miles an hour and travel 2,000 miles without refueling. Steam wheels could be used on cars for rough country because of the superior traction.

Another advantage of individual power wheels is seen by a Wichita, Kans., inventor who has designed a car with electric motors in the hubs. This car, he says, could crawl out of a parking space almost exactly its own length, since the front wheels could turn sideways and revolve under their own power. He visions an automobile of conventional appearance, but with the gasoline engine coupled to a dynamo that will supply power to the wheel motors.

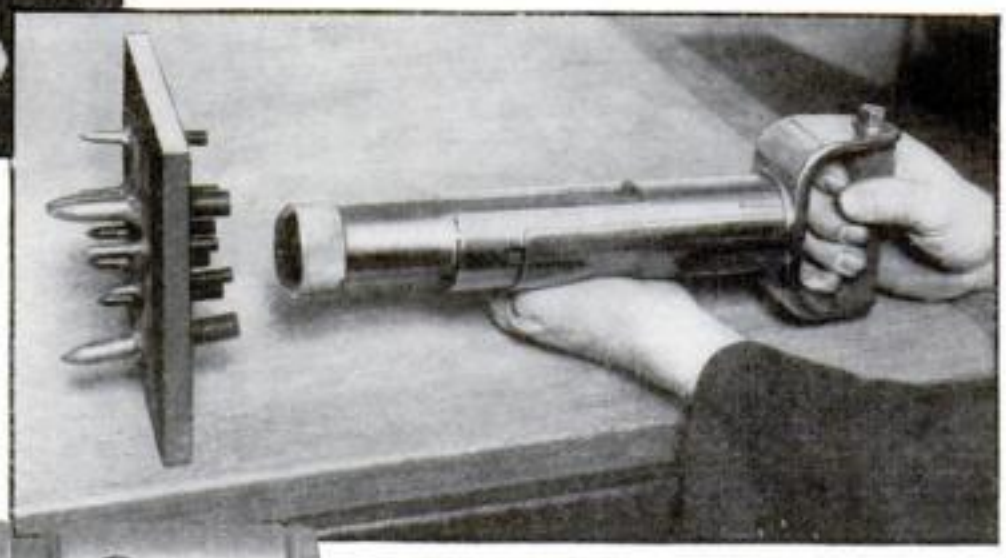
Design for an Automobile Driven by Electric Wheels is Illustrated Below



Gunpowder Now Used to Drive Rivets and Splice Cables



Here are some of the projectiles fired by the industrial guns. At left are two blank cartridges for guns that drive pistons



This queer looking gun shoots rivets through solid steel and does away with boring holes

Above, inserting the tiny cartridge in the "gun" that is used in splicing cables with gunpowder. As the trigger is pulled there is no report, but the dies smash down on the ends of the cable and force them together

Gunpowder is finding many new uses in strangely shaped guns. At right is one that shoots a steel slug with sufficient force to stun an animal. It is used in humane slaughtering of cattle

APPLICATION of gunpowder to such varied tasks as driving rivets, splicing electrical cables, and drilling holes in ships' hulls was demonstrated recently in New York City with the aid of devices perfected by Robert Temple, noted wartime inventor. Devices applying this unusual principle to the needs of modern industry are now ready for commercial use.

A gun that shoots rivets into place eliminates the need for drilling holes in beams. The riveter need only press the trigger, and a tiny cartridge supplies the necessary force to drive the rivet straight through the metal and clinch it firmly in position.

Other guns fire drilling tools through ship's plates, enabling their repair under water without the use of a drydock and permitting tubes to be inserted in a sunken submarine's hull to bring air and food to the imprisoned crew.

Another device, resembling a powerful jack but using the gunpowder principle, splices electric cables with a smashing blow. After they are joined, sawing through the splice reveals a solid mass of metal as closely united as if it had been fused. In splicing cables there is no report, but only a sharp click as the gunpowder-driven dies are smashed down upon the ends of the cable, instantly completing the connection. A large electric concern is said to be considering the use of this device.

GERMANS USE DUMMY IN GAS PRACTICE

A DUMMY with a wooden head and painted features gives students in a German school an opportunity to practice the technique of rescues from poison gas. For some time Germany has been educating its citizens in defense against an enemy gas attack from the air. Classes have been established for the purpose, and the accompanying photograph shows members of one of the schools equipped with gas masks, practicing first-aid treatment upon the dummy. Under the terms of the peace treaty, Germany has not been permitted to have an army since the World War—a fact that makes its preparations against possible hostilities seem wise to its civilians, who have entered readily into the national scheme for instruction in guarding against poison gas.

LIGHT ON UMBRELLA

NO LONGER is it difficult to call a taxicab on a rainy night. A new umbrella with a signal lamp at the tip solves the problem. The bulb is lighted by a switch in the handle, which also holds the battery that supplies the current.

LAST STAGECOACH OF OLD WEST STILL MAKES REGULAR TRIPS

LIKE a ghost from the days of the forty-niners, a stagecoach drawn by six fleet horses dashes, several times a week, along an unfrequented California highway. On the driver's box of the swaying vehicle sits Capt. William Banning of Los Angeles, veteran driver of pioneer times and a son of the man who founded the first stage lines in southern California.

Because he is reluctant to sever his ties with a glamorous past, Capt. Banning owns and operates what is believed to be the only remaining stage line in the West. When the automobile's invasion banished his fine stable from Los Angeles, he moved his establishment, with forge and blacksmith tools, to Walnut, Calif., twenty-five miles away. Then he laid out and built a stage road through ranches and over rolling country to the picturesque little town of Chino, some distance away.

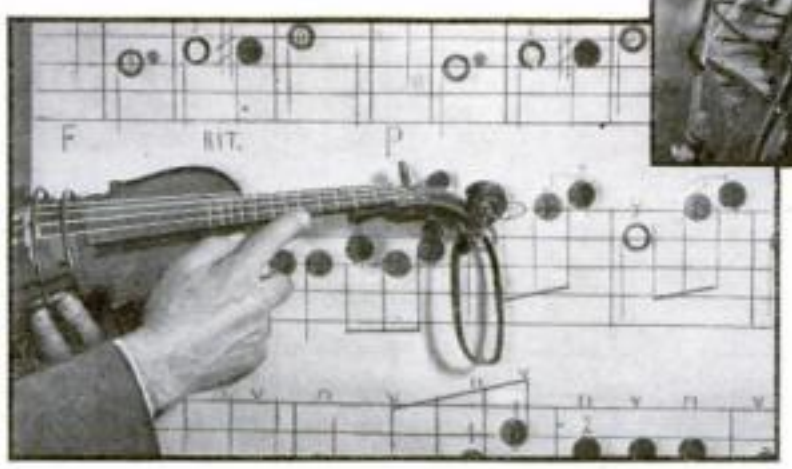
Over this route the seventy-year-old driver runs his prized Concord coach—a venerable, but still serviceable, vehicle that was first put into use before the days of the transcontinental railroads.

PORTABLE BAND SAW DOES SPEEDY WORK

A NEW aid to carpenters is a portable band saw that weighs but twelve pounds. It is easily carried to the place of work, and is said to cut a piece six times as quickly as it can be done by hand. An electric motor drives the labor-saving tool. For a semipermanent installation, it is attached to a convenient bench by a few screws. A shield guards the hands from contact with the blade.

COLORED NOTES HELP YOUNG VIOLINISTS

CHILDREN learn to play the violin and 'cello quickly with a radical method of teaching recently introduced in New York State schools. Music for them to play is written in giant notes, each of a certain color corresponding to its pitch. The fingerboard of each instrument is similarly marked with colors, giving the corresponding finger position for each note. In addition, metal guides make it impossible for the child to use the bow in any but the correct position, as shown in the photograph at the right.



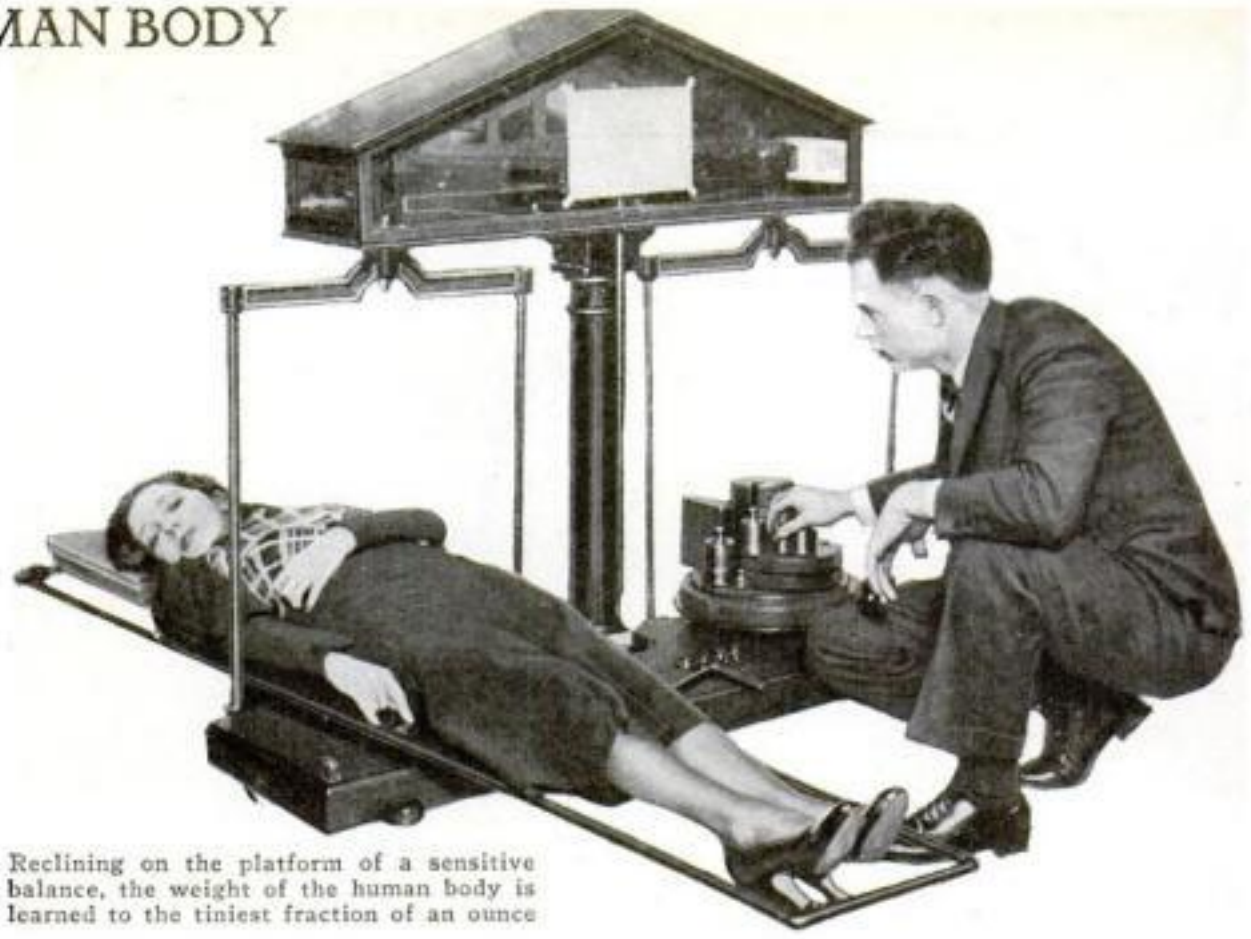
At left, giant colored notes, with similar markings in color on violin's fingerboard, used in New York State schools to help children learn to play. Above, 'cello student with metal guides on instrument to prevent wrong use of the bow in playing

ATOMIC PATTERN SHOWN WITH MAGNETIC BALLS

FLOATING balls of cellulose composition, with centers of cobalt steel, have recently been used to demonstrate the symmetry of magnetic forces. The steel alloy used is one of the most highly magnetizable substances known. When four of the magnetized balls are dropped into a vessel of water, they immediately group themselves in a figure like a three-pointed star, with the outer trio evenly spaced about the center one, as seen in picture at the right. Scientists believe that similar forces govern the arrangement of nucleus and electrons within the atom, and the balls provide a typical model of an atom containing three electrons about a nucleus.

BALANCE WEIGHS HUMAN BODY

So SENSITIVE that it can tell your weight to within one gram, or about one twenty-eighth of an ounce, is a new balance recently exhibited before members of the American Society of Heating and Ventilating Engineers at Cleveland, Ohio. It is being used in a study of the changes by which the human body gains or loses weight, because of minute variations of temperature and humidity. A long platform permits the subject to remain motionless during the act of weighing, as shown in the photograph at the right.

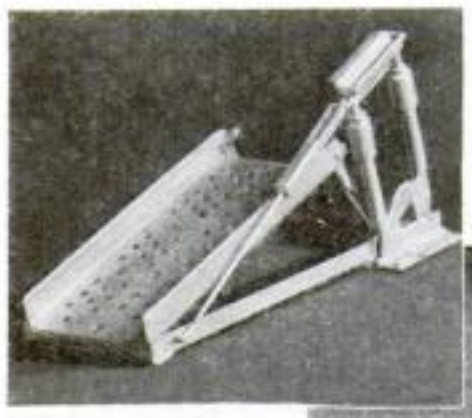


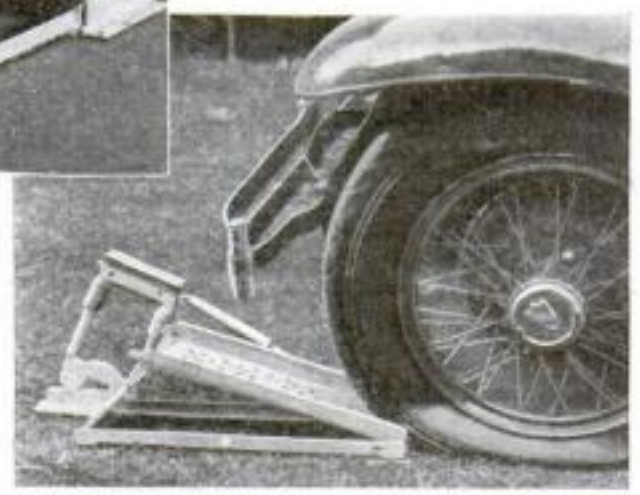
Reclining on the platform of a sensitive balance, the weight of the human body is learned to the tiniest fraction of an ounce

NEW GAS USED TO SAVE PNEUMONIA PATIENTS

ENTER "carbogen" to save the lives of pneumonia victims. Inhaling this new gas, a mixture of oxygen and carbon dioxide, is reported to have proved effective in cases usually considered hopeless. The photograph above shows the strange apparatus developed by two Yale University medical experts to administer the treatment. Carbogen from the cylinder is led into a tentlike chamber with flexible windows that fits closely over the patient's head and shoulders as he lies in bed.

AUTO JACK RUNS CAR UP INCLINE





Above, drive "flat" up the incline on this novel auto jack till brake drum drops into notched support and platform collapses, making possible a quick tire change

AN AUTOMOBILE raises itself to permit changing a tire, with the aid of a jack devised by a Louisiana inventor. Folded, it occupies small space in the tool kit. Should a puncture occur, the motorist unfolds the jack and places it just in front of the wheel. Under the engine's power, the wheel climbs an inclined platform until the brake drum drops into a notched support, with the tire clear of the ground. The inclined platform is then depressed to allow full access while the damaged tire is removed and a new one substituted.

To remove the jack, the incline is raised and the car backed off.

RUBBER REDUCES NOISE OF EARLY MILKMAN

Putting rubber cushions on the feet of milk wagon horses is one of the means used by a big company to reduce delivery noise

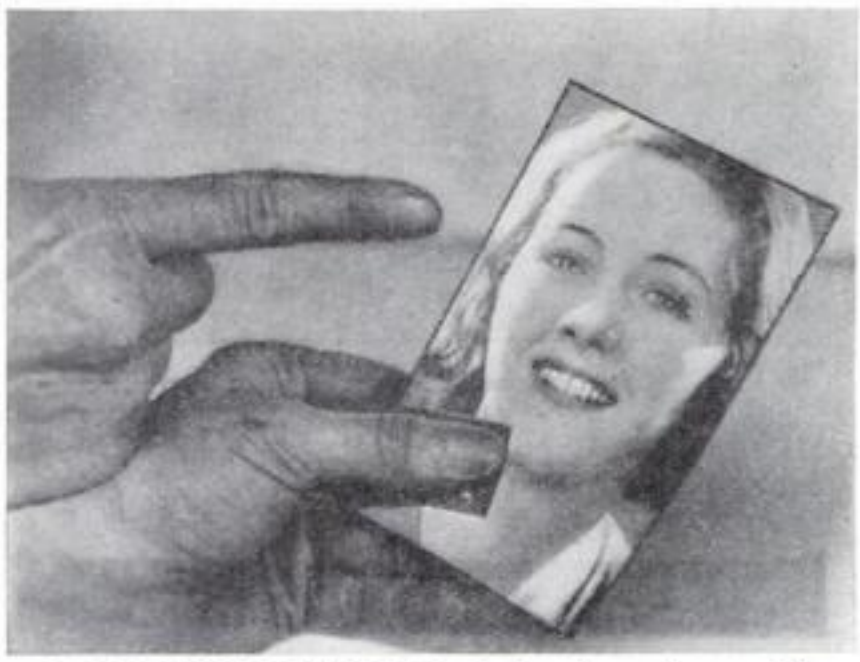
A LARGE milk concern serving New York City has opened its own noise abatement campaign. By equipping its horses with rubber cushions for their shoes, and providing its drivers' milk-bottle baskets with rubber shock-absorbers, it plans to lessen the racket of early morning milk deliveries. Tests have shown the new milk container thirty-one percent less noisy than the old. With many wagons provided with rubber-tired wheels, the late sleeper's dream of a silent milkman seems approaching realization.

DEVELOPS X-RAY PHOTO IN BROAD DAYLIGHT

A CHICAGO dentist develops X-rays of his patients' teeth quickly and in full daylight. During exposure and development the sensitive film is inclosed in a lightproof but moisture-permeable envelope he has invented, shown above.

CHEMICAL TRICKS *You Can Do*

By *Raymond B. Wailes*



A BLUSHING PICTURE. If the face in a photograph is touched with phenolphthalein, a blush will rise in the cheeks when the finger, wet with household ammonia, is held near them

CHANGING WATER TO WINE

Use a sodium carbonate solution, the color of water. This is poured into an apparently empty glass containing a couple of drops of phenolphthalein, which will turn the sodium a wine color. At left, sodium thiosulphate in **bottle stopper turns whisky to water**

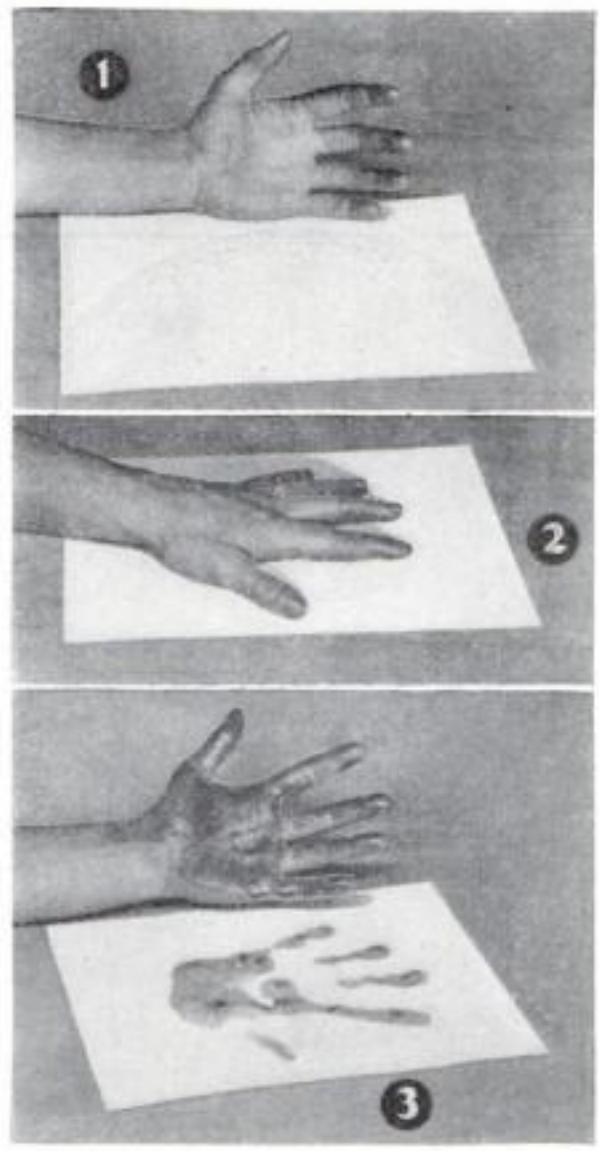
YOUR home chemistry laboratory usually contains all that you need to perform several amusing tricks or stunts. Among the simplest are the color-changing of liquids, or wine-water-ink-milk tricks. Perhaps the most popular of these is the pouring of a dilute sodium hydroxide or sodium carbonate solution (a pea size lump of sodium carbonate dissolved in a tumbler of water) into an apparently empty glass, which in reality contains two or three drops of phenolphthalein solution. The sodium carbonate solution, when poured into the "empty" glass, turns a wine color.

This trick can be modified by using a bit of wax to stick, to the inside of the neck of the bottle containing the sodium carbonate solution, a crystal of citric, tartaric, or oxalic acid. If a colored glass bottle is used the concealed acid cannot be detected. To perform the trick, the sodium carbonate solution is poured from the bottle into the glass containing the phenolphthalein solution. If the bottle is held in such a manner that the flowing liquid does not touch the crystal in the neck, the waterlike solution coming from the bottle turns into a colored solution in the glass. Now if the bottle is set upon the table, again taken up, and the liquid within allowed to flow over the crystal, neutralization will take place and turn the "wine" in the glass back to water.

Filtered limewater, which is water-white, produces a milky suspension resembling milk when mixed with a sodium carbonate solution that resembles water.

A solution of water glass added to hydrochloric acid is transformed into a solid, and if strong solutions are used, the container can be held upside down without the solid falling out.

A simple trick that always causes surprise is performed by shaking a pint flat liquor bottle containing a solution of iodine (tincture of iodine) or a small crystal of iodine dissolved in a solution of potassium iodide in water. At first the liquid looks like whisky. In several seconds, however, without removing the stopper, the "whisky" will turn into water. The secret lies in the fact that a crystal of sodium thiosulphate, or photographer's hypo, is thrust into a hole in the narrow end of the stopper. Shaking, of course, dissolves the crystal, which forms a colorless compound with the iodine water.



BEWARE THE BLACK HAND!

The three stages of this popular trick are shown above. First, white unsoiled paper, into which, secretly, tannic acid has been rubbed. Next a clean hand, privately dampened with ferric chloride, is laid upon the paper—and presto! the black hand appears

A nice little party stunt in which two inexpensive chemicals are used causes a photograph of someone present to blush when the operator points his forefinger at it. For this simple experiment one should touch the cheeks in the photograph with a solution of phenolphthalein. While still moist, the finger tip is dipped into household ammonia and held an inch or two in front of the photograph. The ammonia vapors from the finger will cause the picture to become red, and so seem to blush.

In performing this trick, it is best to dampen the cheeks with a solution of phenolphthalein made by dissolving a bit of the substance in denatured alcohol and allowing to dry. The cheeks are dampened with water before doing the trick, and the finger simply dipped in ammonia water and held in front of the photo.

The popular black-hand trick is performed by rubbing powdered tannic acid into the fibers or pores of a sheet of white paper. This chemical cannot be seen on the paper. The palm of the hand, previously shown clean, is slightly dampened with a solution of ferric (iron) chloride or ferric ammonium sulphate. When the dampened hand is laid upon the paper, and removed, a black-hand print is formed, which seems quite mysterious. The black stain produced here is actually an ink, iron tannate. If the hand is moistened and powdered ferric ammonium sulphate dusted upon the palm, the effect will be even more mystifying, as the wet surface of the palm is then not perceived.

Dilute copper sulphate solutions, almost colorless on paper, will appear deep blue when exposed to ammonia fumes. Hydrogen sulphide gas, when passed into water, yields a solution that gives up the gas when exposed to the air. This gas, allowed to come into contact with a picture painted with certain chemicals, will cause the picture to turn different colors. If a picture is drawn with copper sulphate solution, the gas will turn the almost colorless picture black; if lead acetate solution is used in painting the picture, the gas will give the picture a brown color. Of course, the picture at first is invisible, but develops, or appears, when exposed to the hydrogen sulphide gas.

Latest Inventions FOR HOME USE *And How They Work*

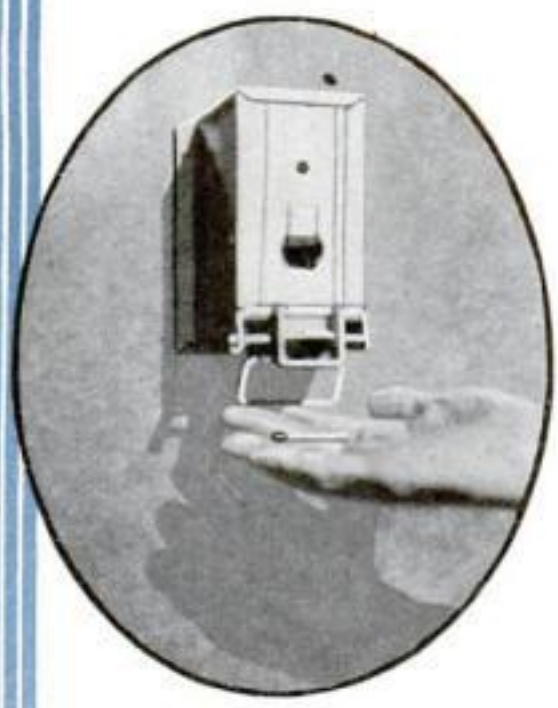
BIRTHDAY CAKE CANDLES. A base with twelve sockets for light bulbs is made to fit the bottom of a birthday cake so it can be lighted electrically

HAND WASHING MACHINE. Above, close-up of a newly designed apparatus for washing clothes in the bathroom sink. It consists of a stick with a rubber attachment that, it is claimed, cleans the fabric by means of pressure, vacuum, rubbing, and circulation

MUSIC IN THE KITCHEN. A new cabinet for the kitchen contains a cleverly hidden radio so that cooking recipes and cheerful tunes are handy for the housewife while she is at work

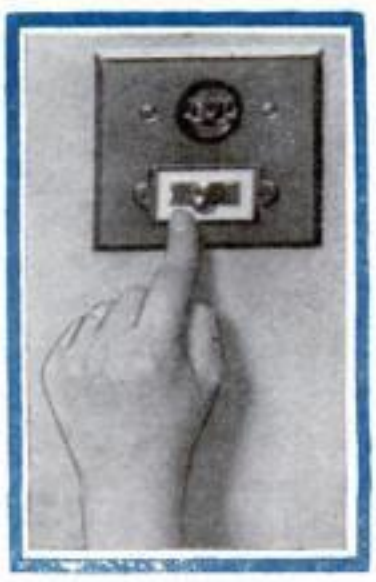
TING! EGGS ARE DONE. A sand-glass gage, used in boiling eggs, has an alarm attachment that is sounded when the last of the sand has run out. Stops can be set for three, four, or five minutes

NOISELESS BLADE FOR FANS. This new type of blade for fans is said to be noiseless and to operate without vibration, and hence can disturb no one while in use

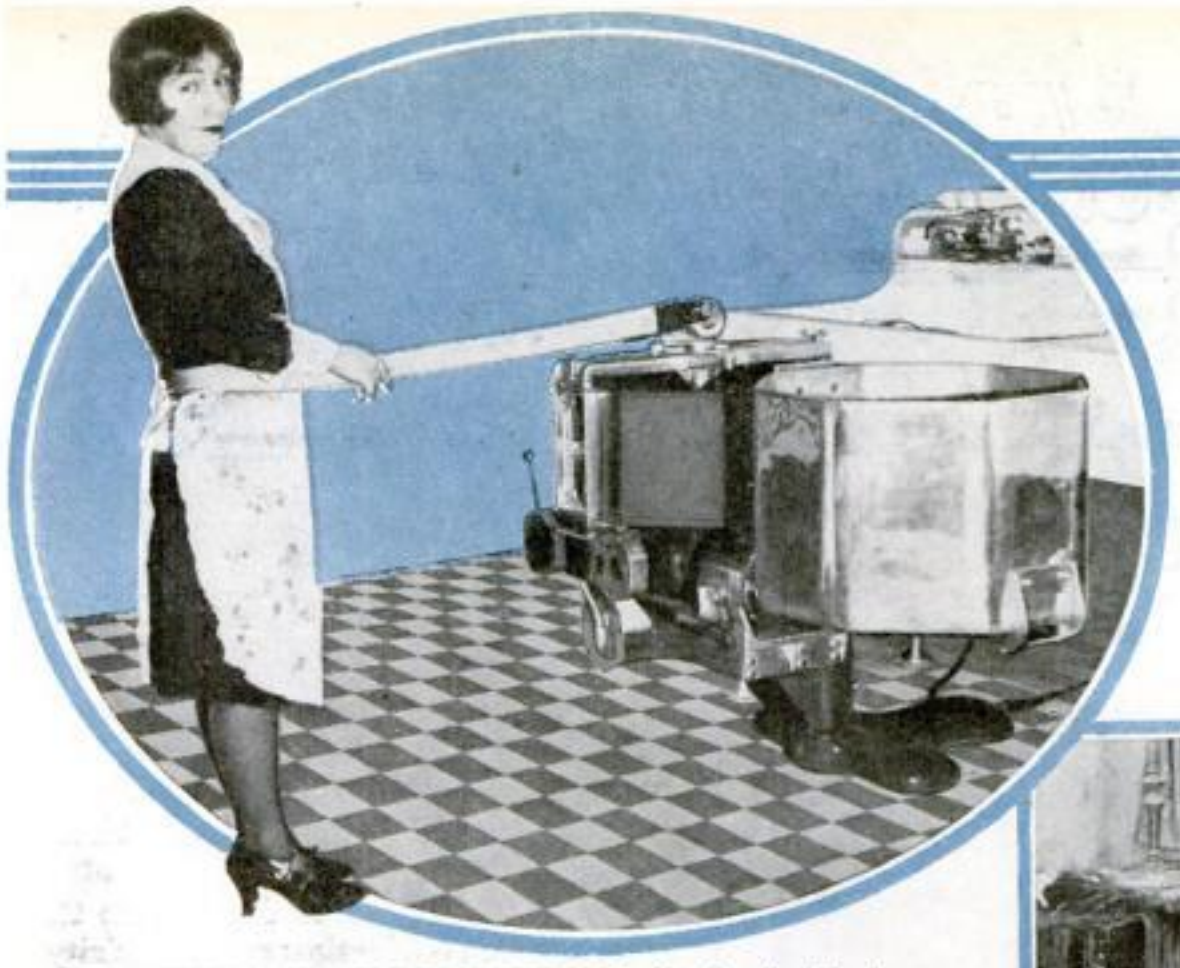


MATCHES ON DEMAND. Wasting time looking for the match box and opening it when found is avoided with a dispenser that hangs on the kitchen wall and at the light pressure of a lever flips one match at a time into your hand

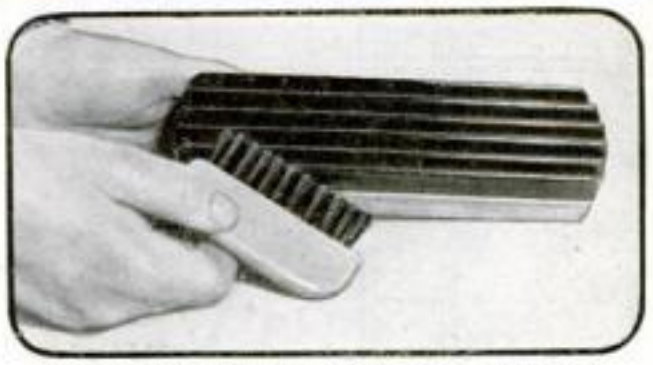
SPRAY OFF THE DIRT. It is unnecessary to scrub vegetables with a brush if this faucet attachment is used. It sprays them with such force and in such fine streams that all the dirt is quickly washed away



SWITCH PLATE SHINES IN DARK. The luminous plate shown at right is intended to do away with the trouble of finding the electric button in an unlighted room, as the darker it is the more easily can the shining plate be seen

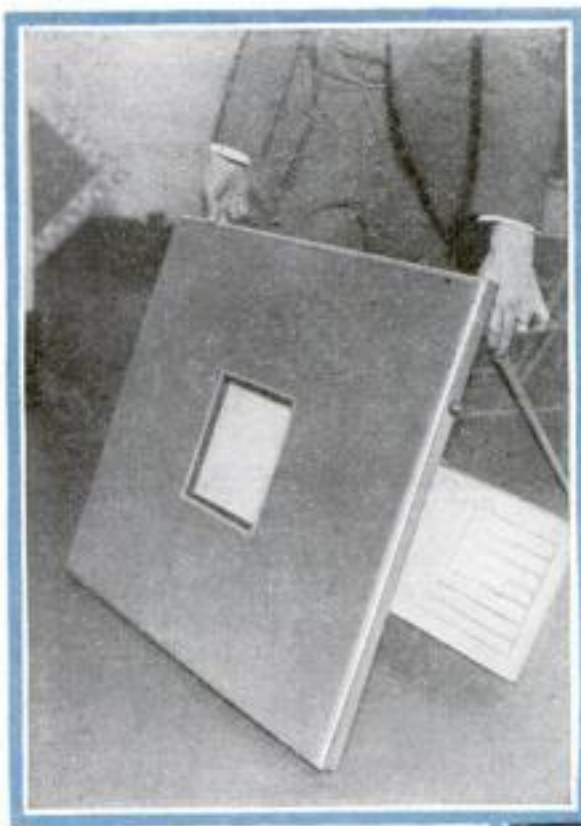


VERSATILE MACHINE FOR THE HOME. Nearly all of the heavy household work can be done with this one machine, according to the manufacturer. It washes and irons clothes, washes and dries dishes, beats eggs, grinds meat, cooks food, and is an exerciser, as shown above



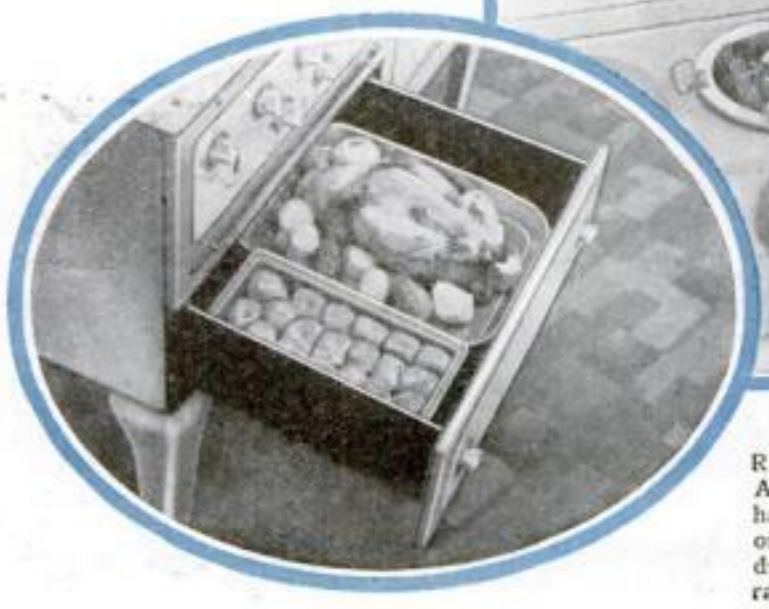
FRICTION BRUSH FOR UPHOLSTERY. The large brush, made of special dust-catching material, picks up lint and dirt. Small bristle brush is used to clean the larger one

NO LONG LAMP CORDS NEEDED. A new kind of electric wiring that looks like molding is designed to be fastened to baseboard of room so that light sockets can be easily and quickly put in at any location

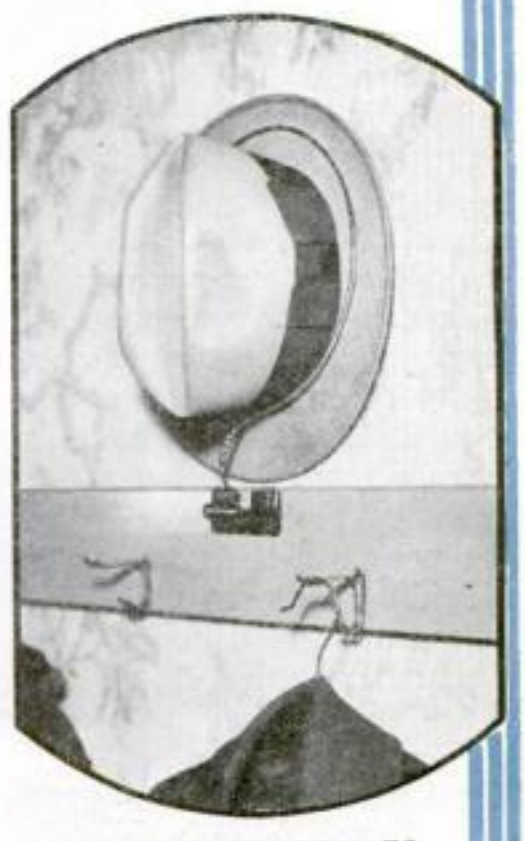


SCORE CARD FOR CONTRACT. Covered with plate glass, sunk flush in the center of the table, this score card is plainly seen by all the players

NEW BATHROOM BRUSH. Shaped like a cake of soap, this handbrush, consisting of stiff bristles fastened securely between spirally wound wires, is a handy aid to cleanliness



RANGE HAS SLOW-COOKING WELL. An electric stove now on the market has a deep slow-cooking well for roasts or vegetables. It also has a warming drawer, shown at left, heated by a separate element in which food can be kept hot



"COAT HANGER" FOR HATS. This wire hat holder, designed after the fashion of coat hangers, clamps to the wall and the wire band, working on a spring, lets the hat slip beneath it and then holds it snugly against the wall

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Editorial

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Harvest of the Laboratory

WHEN Dr. Willis R. Whitney, director of the research laboratory at the Schenectady plant of the General Electric Company, hired the brilliant young physicist, Irving Langmuir, some years ago, he escorted him down a hall and threw open a door.

"There is your laboratory," he said. "Go in, and see what you can find out." That was all—no instructions, no directions, no word of caution, no advice.

Many employers probably would feel that Dr. Whitney was starting a new man on the job in rather a slipshod fashion. Yet the developments of the following years proved beyond doubt that Whitney knew exactly what he was doing.

Dr. Langmuir has become one of the world's foremost physicists. He has just won the POPULAR SCIENCE MONTHLY $10,000 Annual Award for Scientific Achievement as announced on page 26.

What is of greater importance, his achievements prove that research in pure science, no matter how far removed it may seem from the realm of practical things, is of supreme value in the everyday affairs of humanity.

Who, for example, would ever have believed, fifteen years ago, that Langmuir's lengthy study of the reactions, absorptions, and distributions of tiny amounts of gases admitted to almost perfectly evacuated bulbs could ever amount to anything more than a topic for discussion among scientists? Or that the thermal losses from tungsten filaments operating in an atmosphere of hydrogen at high temperatures could ever have even the remotest connection with the affairs of the average man?

Yet the first series of experiments resulted in cutting the nation's electric light bill in half, or rather in providing twice as much light for the same amount of money, which amounts to the same thing. And the fundamental facts regarding the characteristics of hydrogen that Langmuir unearthed led to the atomic welding torch, a potent tool of great importance in metal working.

The Birth of Astronomy

THE ancients, when they wanted to get away from the commonplace cares of life, indulged in abstract speculations about the make-up of the material universe, including the heavenly bodies. These discussions didn't do the ancients any practical good, but there would be no such things as ocean liners or international commerce if what we now call astronomy hadn't been born out of them.

Michael Faraday delved deeply into the relation between magnetism and electricity, both subjects being at that time of interest only to students of pure science. Yet all our modern developments in the practical use of electricity sprouted from the facts Faraday discovered.

The researches of Crookes and Geisler into the behavior of electrical currents in partial vacuum, an investigation which at that time seemed of no apparent practical value, led Roentgen to the discovery of the X-ray, one of the two greatest contributions to the Science of Medicine, the other being anesthesia.

The radio, the telephone, the telegraph, photography, motion pictures—all trace back to the discoveries of some worker in the field of pure science. The airplane, though, is a notable exception. Practical flight had been achieved by rule-of-thumb methods before the laboratory men worked out the mathematical laws governing the design of correct wing shapes.

Where Theory and Practice Meet

OF COURSE, not all practical improvements come as an immediate result of abstract scientific research. The basic facts discovered by pure science must be taken in hand by the practical scientist and engineer who develops their commercial application.

The student of pure science and the practical engineer have essentially different points of view. The former rarely gives more than a passing thought to money matters and is quite definitely uninterested in piling up a fortune for himself except insofar as it would aid him in further research.

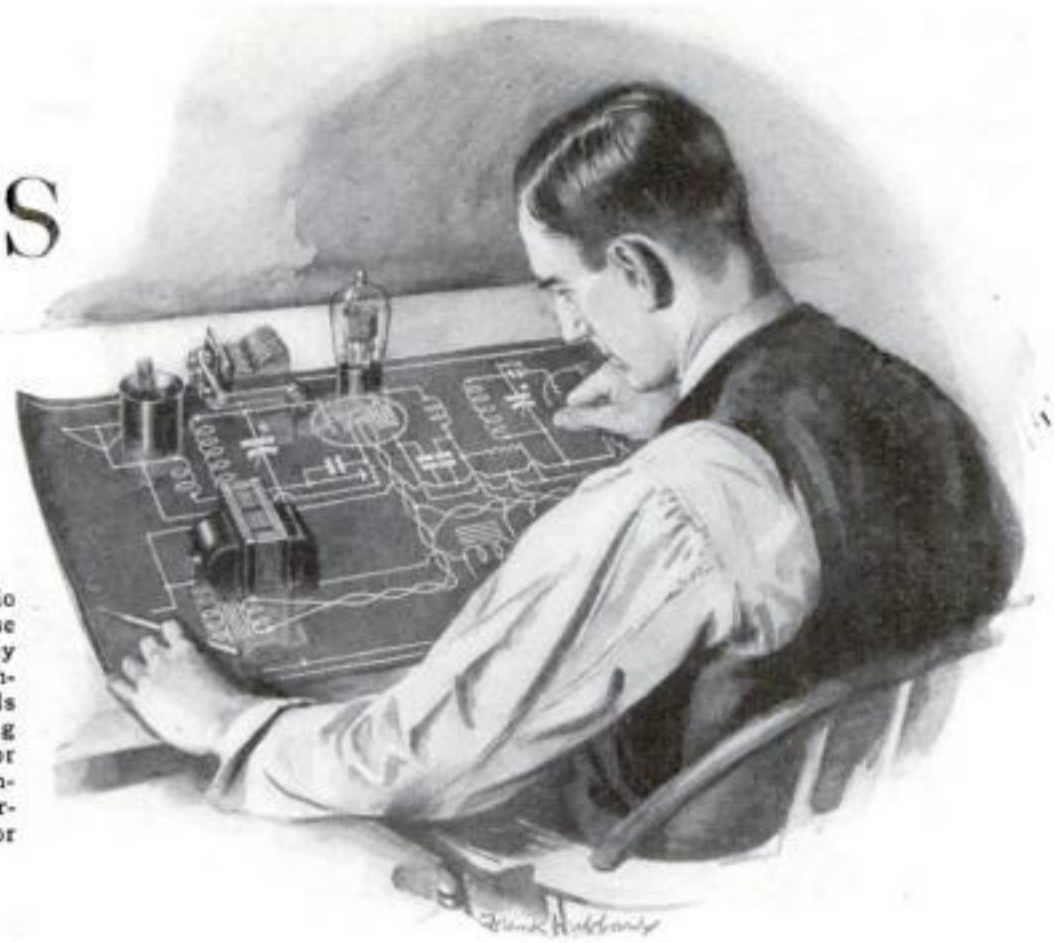
The practical engineer thinks of things in terms of how they may be changed or developed so that they may be made useful and of commercial value.

Those of us who have no interest in or understanding of the mechanical and scientific side of life—and that emphatically does not include you, as otherwise you would not be reading POPULAR SCIENCE MONTHLY—may consider themselves mighty fortunate that Nature continues to produce regularly both types of scientific brains.

The material prosperity of humanity and possibly the continued existence of the human race depend on both classes of scientific minds.

Reading BLUEPRINTS

Is Just Child's Play If You Start Right



LINES on a radio blueprint may confuse you at first, but they will soon sort themselves into symbols with definite meaning if you study them for a moment after learning what the different symbols stand for

By ALFRED P. LANE

LIKE a lot of other tricks, reading a radio blueprint is astonishingly easy once you catch on to it. Yet radio blueprints, or, in fact, blueprints of any kind, always will remain just so much Greek to thousands of radio fans.

Show a five-year-old child a picture of a house or a cat or a dog and the youngster doesn't have to be told what it is, yet the child is performing with ease precisely the same stunt a man balks at when he throws up his hands in despair at sight of a radio diagram. In each case the problem is to interpret in terms of solid objects with length, breadth, and thickness lines drawn on a flat piece of paper.

When anybody, even an expert, first looks at a blueprint of a radio diagram his first impression is of a maze of lines. Then, in a moment, the lines sort themselves into an orderly arrangement. Further study reveals familiar symbols: the looped line that means a coil of wire, or the short, heavy, parallel lines that stand for a condenser. Your mind, then, will call up a vision of the parts that correspond to these symbols.

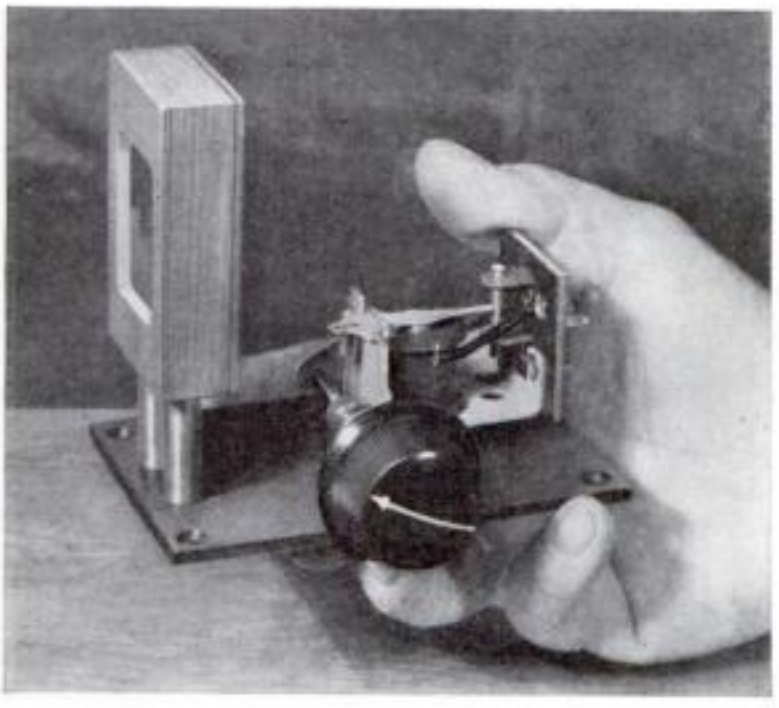
It must be obvious that no one can read a radio diagram who hasn't the faintest idea of what radio parts look like. Learning the appearance of radio parts, however, is merely a matter of looking through a radio catalogue and studying the illustrations. Use your imagination to help you solve the relation between the symbols and the parts they represent. You will find, in every case, that the symbol is just a picture of the simplest part with framework, supports, and other strictly mechanical details omitted.

The symbol for a variable condenser, for instance, is a picture of its essential electrical parts. That is, the two parallel lines represent an edgewise view of two metal plates with a small gap between them. As it would be possible to make a condenser of any desired capacity with just two metal plates, provided they were big enough, it is not considered essential to show, in the symbol, that several smaller plates are used for mechanical convenience. Keep this in mind when you encounter a symbol you have never seen before, and you will have no difficulty in figuring out what it represents.

POPULAR SCIENCE MONTHLY radio blueprints always give both the picture wiring diagram and the corresponding theoretical or symbolical diagram of the circuit.

The picture wiring diagram often is preferred by beginners, but the more experienced radio fan instinctively turns to the theoretical diagram because he can tell from it what the circuit is and how it works far more rapidly than from the picture arrangement.

When you tackle a radio diagram, you ought to remember two things: First, expect it to look like a maze till you have studied it a bit; second, use your imagination.



At left, a small selenium cell of medium speed that can be used, in connection with a relay, to open garage door. It can be assembled, without power mechanism, at a cost of fifteen dollars or perhaps less

Light Sensitive Cells

EXPERIMENTERS in radio will find light sensitive cells offer an interesting and productive field.

There are many types of these cells, ranging in price from three or four dollars up to thirty dollars or more. Some of them require the use of elaborate apparatus that runs the cost of the complete equipment to many times that figure.

As speed in action is not required, it is possible to carry out many experiments, such as the opening of a door by a beam of light, with an inexpensive cell and relatively simple apparatus. Below, left, is a simple unit of this kind consisting of a selenium cell and a small relay mounted on bakelite. Dry wood would serve as well.

This selenium cell, when in darkness, has a steady current flow of approximately two milliamperes when the applied voltage is twenty. A forty-watt electric light bulb, placed one foot from the cell, or a beam of light producing the same amount of illumination on the cell, increases the current flow to six milliamperes. The relay is, of course, set so that it does not quite attract the armature that holds the contact, but closes the circuit at once when the current flow is increased.

The focused beam of an auto headlight many feet away produces a light equivalent at the cell to a forty-watt bulb only a foot away, so that this cell could be used to control an electric garage door opening system. The tiny relay shown will not, itself, handle the heavy current flow of, say, a quarter horsepower motor, but an inexpensive additional relay to close the motor circuit contacts could easily be made out of a doorbell or buzzer.

This selenium cell is so relatively slow in action that it is absolutely unsuited for television or talkie uses.

Short Wave Set

Details of Simple Receiver Batteries or Hooked Up to

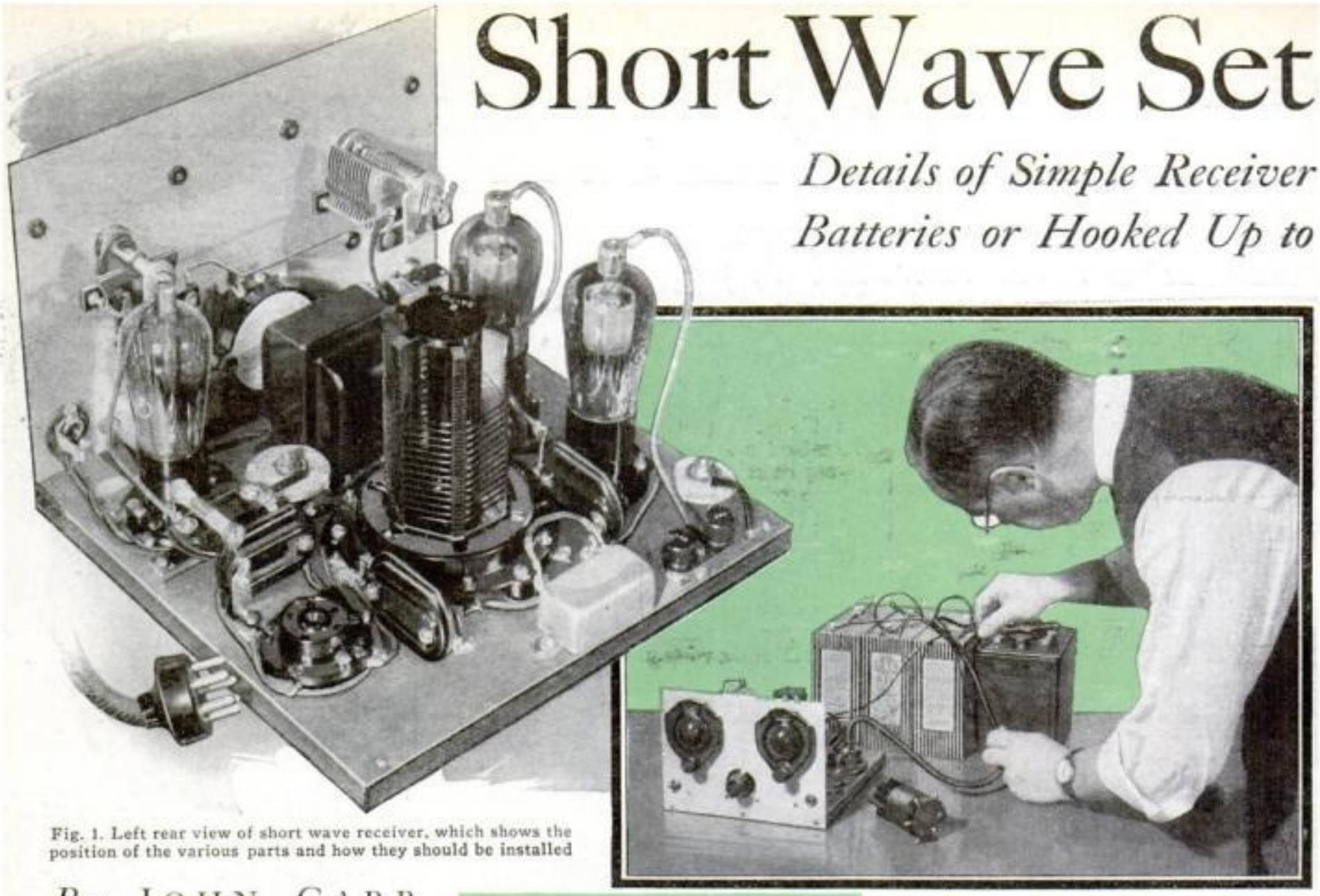


Fig. 1. Left rear view of short wave receiver, which shows the position of the various parts and how they should be installed

By JOHN CARR

ALTHOUGH the gateway to amateur radio two-way communication is a Government examination for a radio operator's license, as was explained last month, you can get into the receiving end of the game as soon as you wish—the sooner the better. In fact, your study of the code will be greatly helped by hours of listening on the amateur waves. Of course you won't be able to copy much of what you hear, but what you do get will encourage you and add interest to your regular practice.

The simple radio receiver detailed on these pages is designed especially for amateur reception on the wave bands or frequencies assigned to amateur work. It incorporates the best practice as worked out by amateurs in practical two-way communication. It can be operated with no changes in the wiring on either a six-volt storage battery and dry cell B batteries or on 110-volt alternating current with a center-tapped filament-heating transformer and any standard B eliminator.

It is also possible, by changing the arrangement of the filament wiring, to operate it on 110-volt direct lighting current. You need only connect the heater elements in series instead of in parallel so that a fixed resistance, such as an electric light bulb of suitable wattage, can be used to control the flow of current in the heater circuit.

The circuit consists of an untuned stage of radio-frequency amplification using the new type 236 screen grid heater tube that operates with six volts connected to the heater circuit and consumes only .3 of an ampere. This tube feeds into a regenerative detector circuit that also employs the type 236 screen grid tube. Then there is a single stage of impedance coupled audio amplification using the new type 238 heater six-volt power amplifier tube.

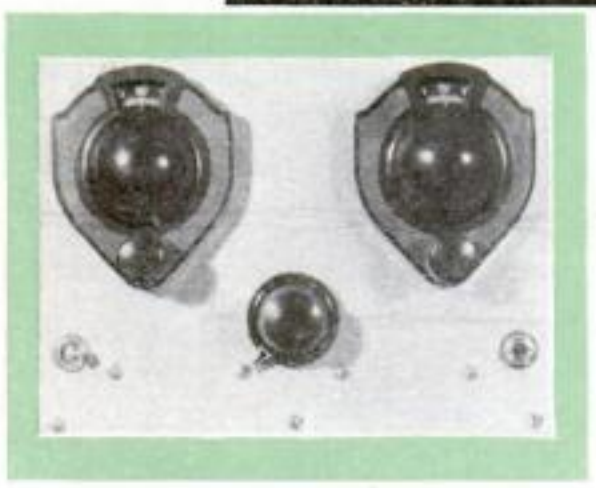


Fig. 2. Connecting up the short wave set at Popular Science Institute for final test. At left, arrangement of controls on panel

Of course, the circuit also will work with the corresponding types of 2-volt tubes or the tubes of similar characteristics used in ordinary broadcast sets.

A feature of this circuit is the band-spreading arrangement. The 20, 40, and 80 meter amateur bands cover, in each case, only a narrow group of frequencies. In order to separate the many stations operating, it is necessary to spread these stations out over as many dial degrees as possible.

Note that there are two tuning condensers *G1* and *G2*. One of these is of relatively large capacity and is used to adjust the circuit to each band of amateur frequencies. Once this condenser has been set for a given frequency band, tuning within that band is accomplished entirely by the small, single-plate condenser.

It is entirely practical to use this receiver to bring in short wave broadcasting which takes place outside the amateur bands and also to bring in the broadcast stations all the way up to the lowest frequency used in broadcasting, merely by adding the necessary coils to your equipment.

The plug-in coils used in the receiver are of commercial manufacture and can be obtained wound to receive any of the frequencies above suggested, or the blank forms can be had at lower price if you prefer to do the winding yourself.

Any other corresponding type of commercially-made plug-in coils and mounting

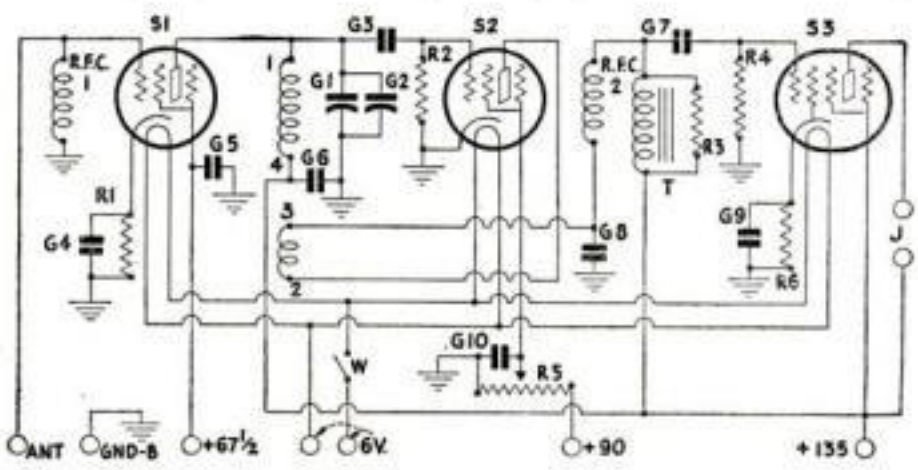


Fig. 3. Theoretical wiring diagram of the short wave set detailed here

for Amateurs

That Can Be Operated with the Electric Light Current

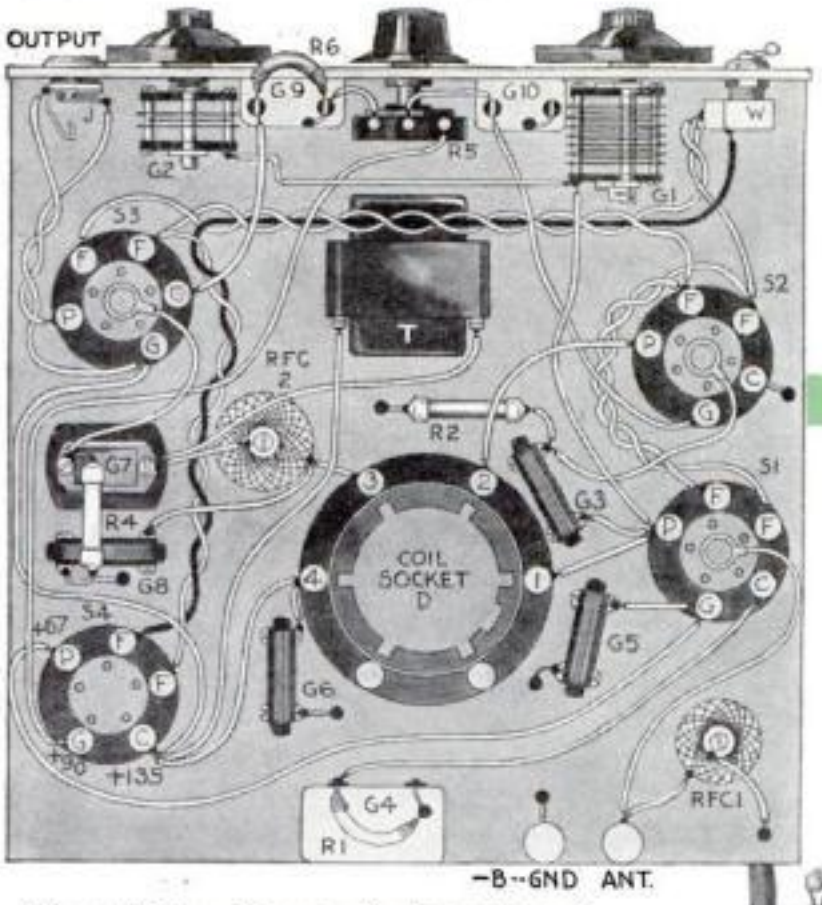
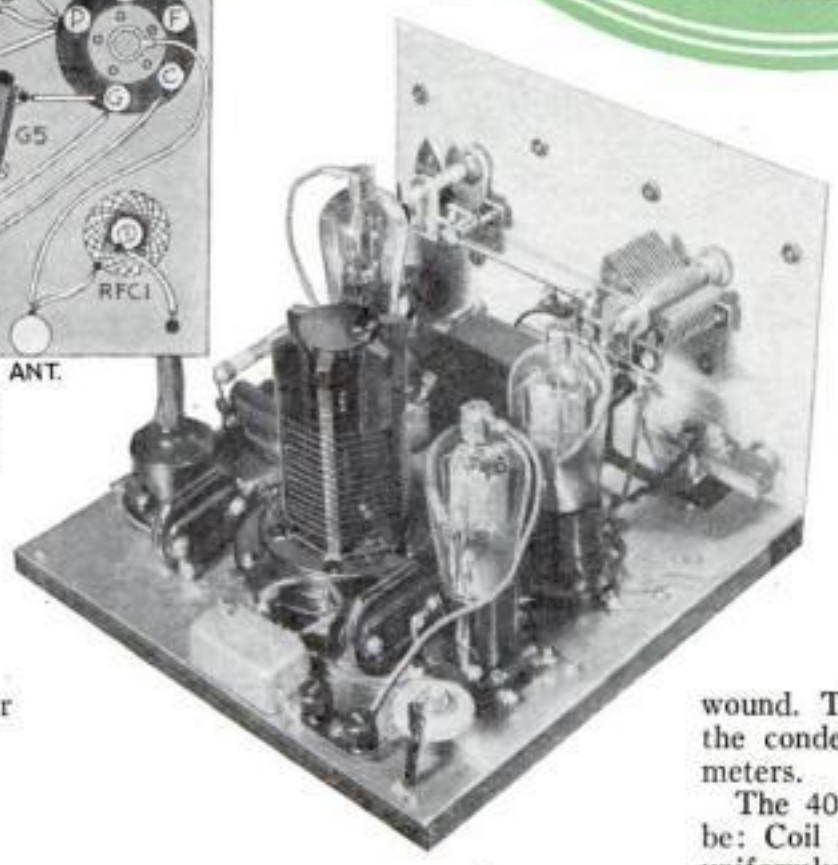


Fig. 4. Picture diagram showing parts and position in the set. At right, rear right view with the parts properly assembled in receiver



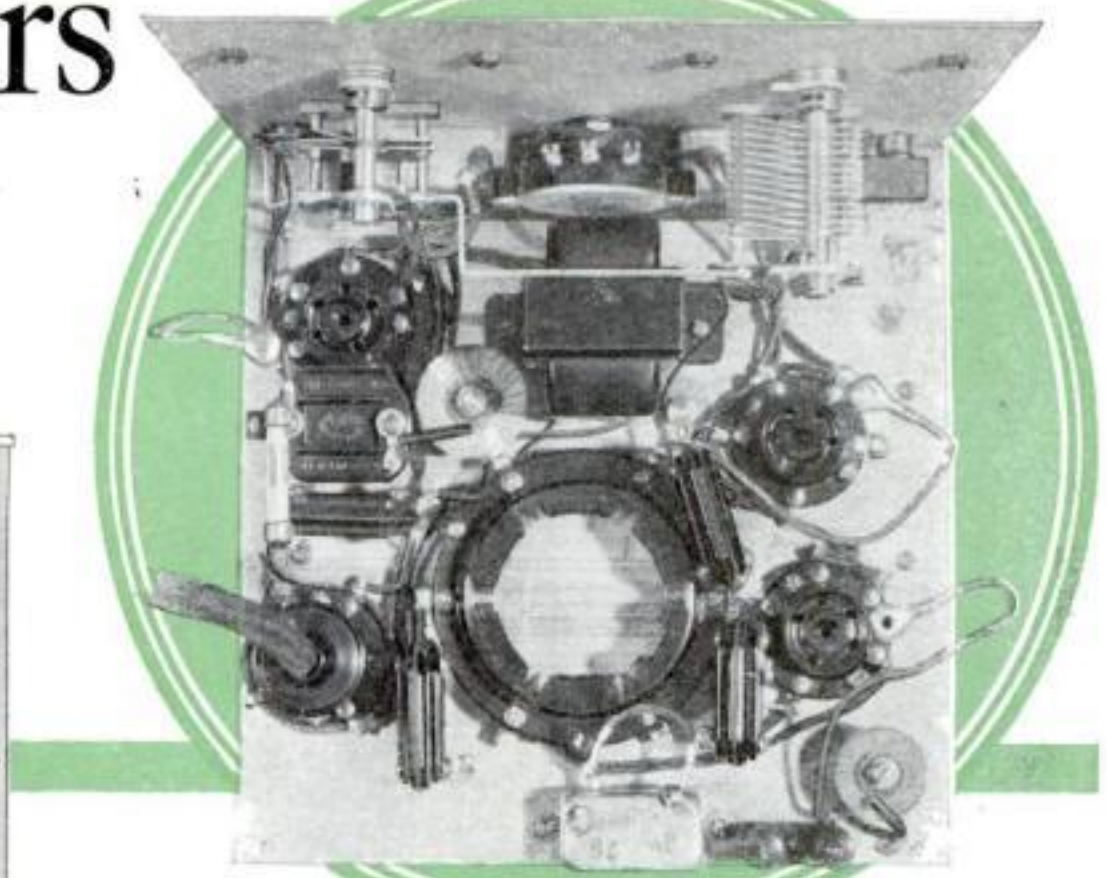


Fig. 5. Photographic top view of set, which corresponds to the picture diagram at left, to help you in assembling parts

can be used if desired, or you can wind tube base coils as described last February (P.S.M., Feb. '32, p. 73).

To build this converter unit you will need the following parts:

A, *B*, and *C*—Set of coils for amateur band reception.

D—Coil socket.

G1—Variable condenser, .00014 mfd.

G2—Variable condenser, .00002 mfd.

G3—Fixed condenser, .0001 mfd.

G4, *G9*, and *G10*—Fixed condensers, .5 mfd.

G5 and *G6*—Fixed condensers, .005 mfd.

G7—Fixed condenser, .002 mfd.

G8—Fixed condenser, .001 mfd.

S1, *S2*, *S3*, and *S4*—Y-type sockets.

R1—Fixed resistance, 500 ohms.

R2—Fixed resistance, 2 megohms.

R3 and *R4*—Fixed resistances, .5 megohms (*R3* is built into T)

R5—Potentiometer, 50,000 ohms.

R6—Fixed resistance, 2,000 ohms.

RFC1 and *RFC2*—Radio-frequency choke coils.

J—Output jack.

W—Filament switch.

Baseboard, panel, battery cable plug, vernier dials, etc.

If you have done any radio experimental work, you probably have on hand some of the parts called for. Before using them be sure that they are of the required electrical specifications. This applies particularly to the various fixed resistances and the fixed condensers of small capacity. Of course, for parts *G4*, *G9*, and *G10* using larger capacity condensers, say 1 microfarad, will not affect the working of the circuit.

Here are the coil specifications for the benefit of those who prefer to purchase the blank coil mountings or to build home-made mountings. While amateur operation is permitted on seven different bands of frequencies, the bands most used are from 20.83 meters to 21.43 meters or 14,000 to 14,400 kilocycles, 41.1 meters to 42.9 meters or 7,000 to 7,300 kilocycles, and 75 meters to 85.7 meters or 3,500 to 4,000 kilocycles.

The 20-meter band coil unit *A* should be as follows: Coil *A1*, 5½ turns of No. 18 wire uniformly spaced to a length of 1⅛ inches. Coil *A2*, three turns of any fine wire tightly wound. This coil will actually cover, with the condensers specified, from 18 to 38 meters.

The 40-meter band coil unit *B* should be: Coil *B1*, 13½ turns of No. 18 wire uniformly spaced to a length of two inches; coil *B2* should have four turns of fine wire. This coil covers from 34 to 70 meters.

Coil unit *C*, which covers from 60 to 120 meters, should be: Coil *C1*, 22½ turns of No. 22 wire uniformly spaced to a length of 1⅝ inches with coil *C2* wound with five turns of fine wire.

The effective diameter of these coils is 1 15/16 inches and the spacing between coils *1* and *2* in each case is ¼ inch.

Terminals 1 and 4 of coil mounting base *D* make contact with the terminal lugs of coils *A1*, *B1*, or *C1*.

Terminals 2 and 3 of the coil base unit make contact with the lugs on the coil forms connected to the ends of coils *A2*, *B2*, or *C2* with terminal 2 connected to the end of the coil that starts around the coil form in the same direction as does the lower end of the corresponding *A1*, *B1*, or *C1* coil.

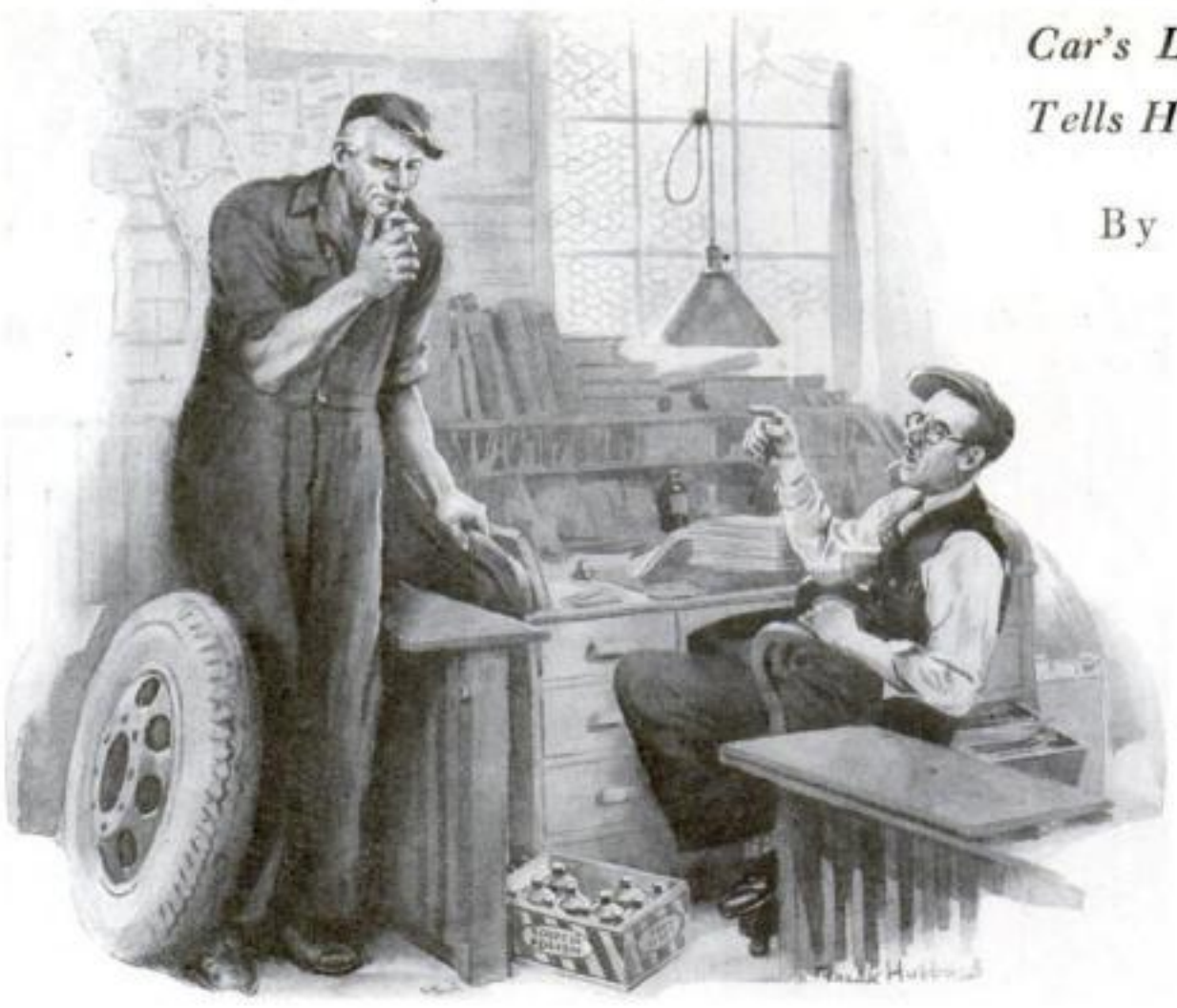
The base of the receiver is of wood covered with thin sheet copper or aluminum. Copper is better because the metal base covering forms the common minus B connection and it is easy to solder wires directly to it. *(Continued on page 127)*

Blueprint READY!

THIS Amateur Short Wave Receiver is described in still greater detail in Blueprint No. 155. Complete hook-ups are given for operation on six-volt A battery and dry cell B batteries, 110-volt alternating current, and 110-volt direct current as well as for the new two-volt tubes and the air breathing battery. See page 110 for blueprint order blank.

BEWARE of Polish That Eats Away Car's Lacquer, Gus Warns as He Tells How to Keep Auto Like New

By MARTIN BUNN



"There's stuff in this polish," Gus said, "that's sure to damage a car's finish"

Why *Cleanliness* PAYS on CHASSIS and MOTOR

"WHERE'D you get this stuff?" Gus Wilson asked as he picked up a gaudily decorated can that was resting on the edge of his partner's desk in the office of the Model Garage.

"That's a marvelous new auto polish, Gus," Joe Clark replied as he pushed aside the pile of bills in front of him. "A couple of swipes with that'll put a shine on the dingiest old crock you ever saw. We ought to be able to sell a lot of it."

Gus shook the can, then unscrewed the cap and moved it in front of his nose as he cautiously sniffed.

"Marvelous polish, eh!" he growled. "A couple of swipes give you a grand shine, do they? Well, I'll bet another couple of swipes or so'll take the finish off altogether. That would be grand stuff to sell if the Model Garage was in the repainting business. How much of it did the salesman stick you for, Joe?"

"Only a dozen cans," Joe replied. "He said it wouldn't hurt any auto lacquer. Are you sure it's no good?"

"My nose tells me there's stuff in it that's sure to damage the finish if you use it much," said Gus. "If you don't believe it, polish a spot on the fender of the service car every day for a week and see what happens."

At the end of the week, Joe called Gus over and pointed to a spot a few inches square in an inconspicuous place on the service car's rear fender. Although the finish glowed with a fine shine at that point, there was a small streak in the middle where the gleam of bare metal showed through.

"You win, Gus," Joe admitted, as Gus examined the spot. "Guess we'd better throw the rest of the stuff in the ash can."

"That's the place for it," Gus smiled, "only I hope it doesn't eat holes through the ash can!"

"What I want to know is, how does that fellow you call 'polishing Pete' get by with all the polishing he does without taking the finish off? He spends nine tenths of his time polishing his car and the other tenth riding around town to show people how swell it looks."

"IN THE first place," Gus said, "Pete knows a thing or two about polishing a car. He uses one of those hard wax finishes that takes a bit of elbow grease to apply, but which actually forms a protective coating over the lacquer. Then, instead of letting the car go till it's all covered with mud and grime, he goes over it with a duster when he gets home and then gives it a light rubbing with a clean soft rag. Road dirt and scum never have a chance to harden on the surface of his car and so he doesn't have to dig away a lot of the lacquer itself to get a polish."

"But that can't go on forever," said Joe. "No matter how careful he is there'll come a time when the finish gets shabby and nothing but a polish with a bit of bite to it will restore it. What does he do then?"

"What every one else does," Gus explained. "He uses a good cleaner or one of the good combination cleaners and polishers.

"That's one of the things that people don't seem to understand about lacquer finishes. They don't check or crack and they don't peel or flake off as the old paint finishes did. But time takes its toll of lacquer just as it does of most everything else. After a while, depending mainly on how much ultra-violet light from the sun actually reaches the finish and also on changing temperatures, moisture, atmospheric gases, and so on, the extreme outside skin of the lacquer coating gets rotten and discolored. The only way you can bring back the finish then is to strip off this skin of broken-down lacquer so as to get down to good lacquer again.

"THAT'S why even the really good lacquer cleaners and polishers seem to make the color of the finish run onto the rag. It isn't color you see, it's the particles of dead lacquer being rubbed off that color the rag. If you let the finish go long enough without any cleaning at all, you can rub your dry finger over it and it will show the color of the dead lacquer particles."

"Then no matter what you do, the finish is bound to go in time, isn't it?" Joe broke in.

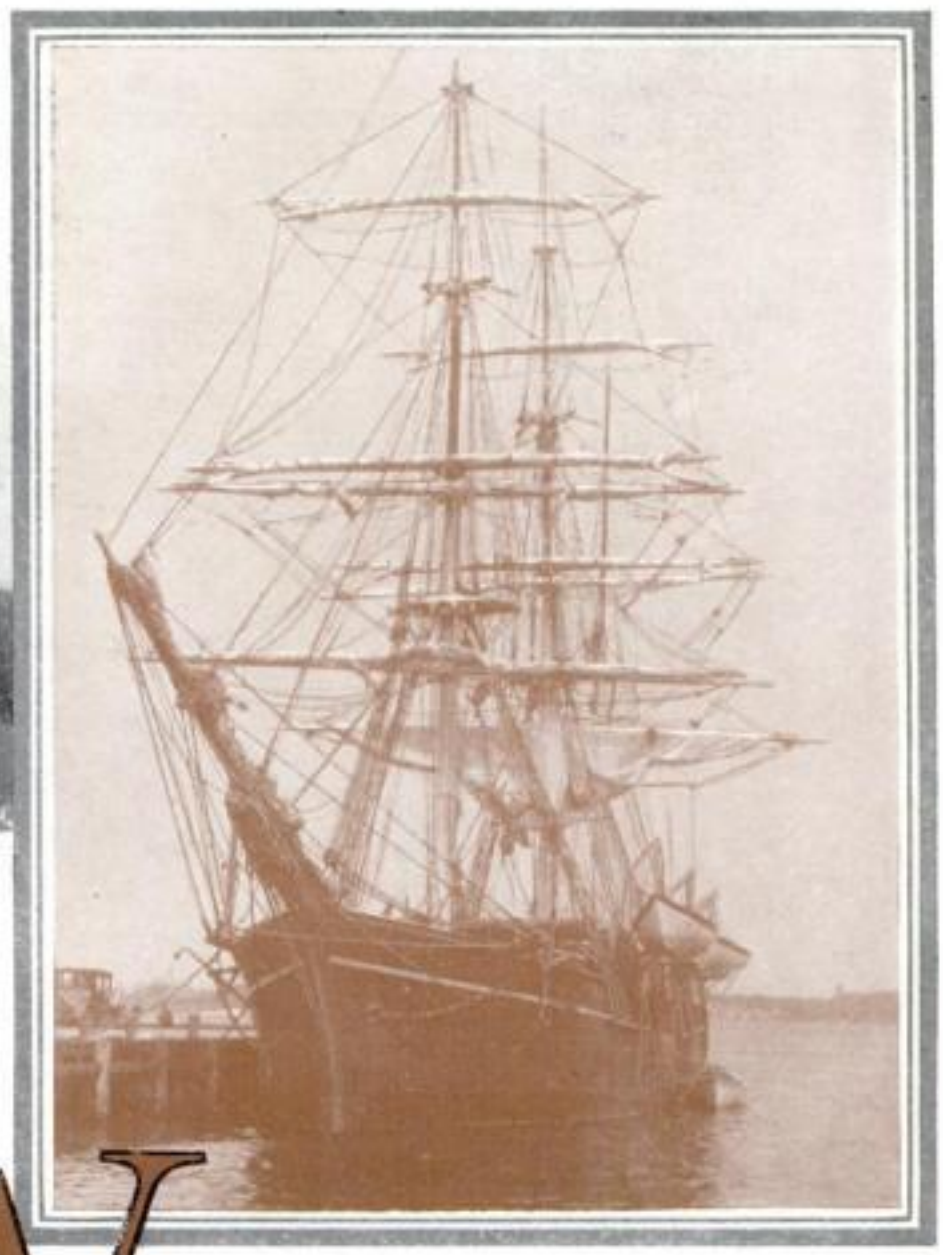
"Of course it is," Gus replied. "But if you take care of the lacquer finish on any car made today, it'll look fine as long as the car lasts. Of course, that doesn't apply to a car that is garaged in the street or back yard without shelter.

"Another thing lots of car owners don't know yet is how important it is to dry a car right after *(Continued on page 126)*

GUS says:

Lots of fellows buy their cars on the installment plan. Why not apply the same principle to your repair bills? Instead of letting things go till they pile up into a job that will nick you for a big roll, it's a lot easier to have repairs done as soon as they become necessary. If you let a lot of little items go till they all have to be fixed at once, the bill won't be nearly so easy to handle.

THE HOME WORKSHOP



Capt. E. ARMITAGE MCCANN'S
latest and best model . . .

The Whaling Ship "Wanderer"

For the convenience of the many readers who find it difficult to obtain exactly the right supplies for ship model making, the Popular Science Homecraft Guild has prepared kits containing all the raw materials for the new whaling model as listed on page 78 except the paint. Heretofore it has been necessary to go from store to store in a time-consuming and exasperating hunt for the necessary items and then pay a high price for a wastefully excessive quantity. The Guild has now ended all this. It will send one of the kits, together with the four whaler blueprints (worth $1.00), to any reader in the United States for $6.90. This includes all shipping charges. Additional details are given on page 109.

IN THE old days, whaling was desperate business—and big business, too. Many an American fortune was founded by the efforts of the grim and incredibly courageous crews of whaling ships. Their hardihood and seamanship were the pride and boast of every New England port. It is not surprising, therefore, that so many readers have expressed a desire to build a model of one of these stanch and sturdy whalers.

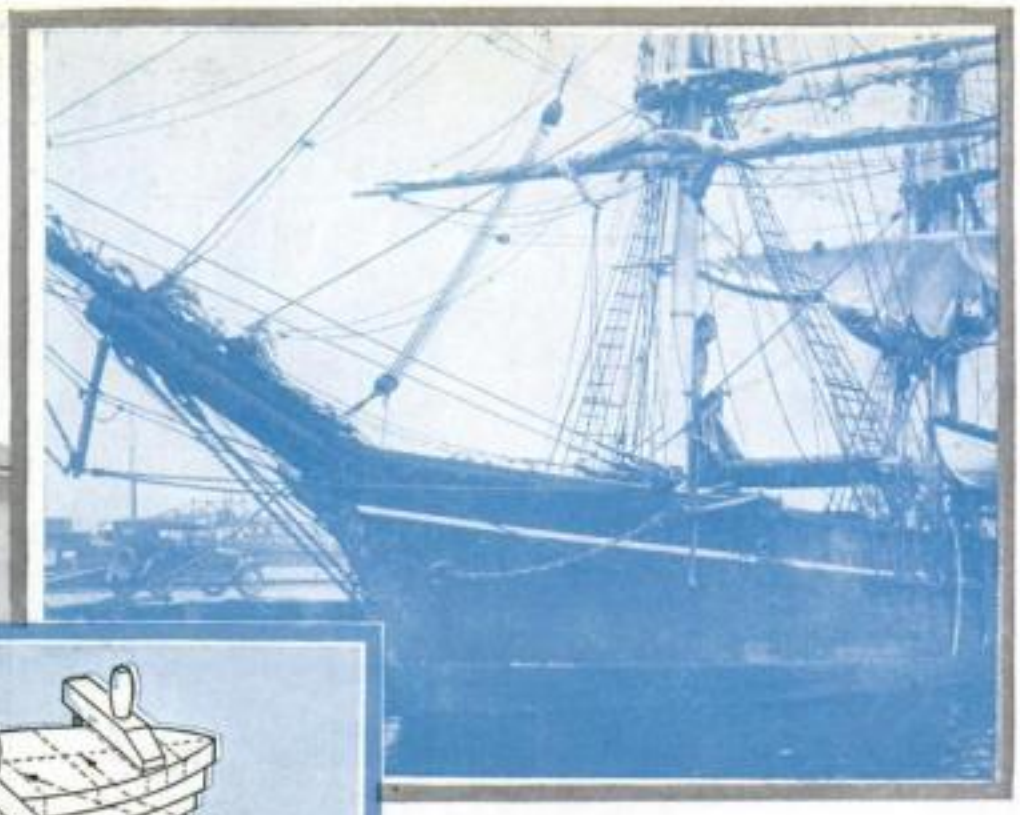
This article and three others to follow will tell how to construct an accurate and beautiful model of one of the most famous of these ships—the American whaling bark *Wanderer,* of New Bedford, Mass.

The *Wanderer* was the last active vessel of a long line of New England whalers. These vessels (with the clippers) used to be the mainstay of the East Coast and piled up many large fortunes for their enterprising owners. Sailing away on one-, two-, or three-year voyages, they would pay dividends up to 300 percent or even more—but sometimes a voyage would be a complete loss. It was an extraordinarily hazardous and adventurous business.

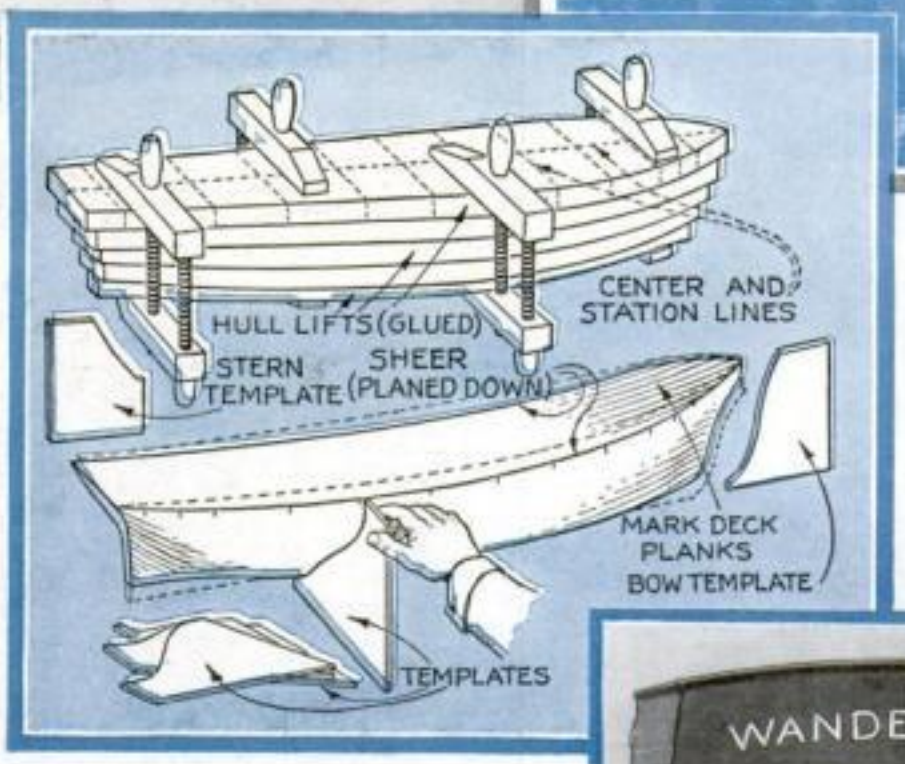
The growth of the petroleum industry, combined with the increasing scarcity of the whales, caused hundreds of American whaling vessels to disappear from the sea between 1846 and 1906. By 1898 there were only fourteen whaling craft on the Atlantic Coast with a catch of 15,520 barrels of sperm oil, as compared in 1846 with 735 vessels, which brought in a catch of 95,217 barrels of sperm and 207,493 of whale oil.

Of all these vessels the only two left in

Templates cut out from cardboard according to the body plan on Blueprint No. 151 act as gages for shaping hull



This photograph and one on the page before show the appearance of the *Wanderer* herself



How five pieces of pine, after they are sawed to shape, are glued together to form the hull block and then carved to match the templates

Shown at the right is the lettering to be painted on the model. The letters are white on black and should be small

1924 were the *Charles W. Morgan*, laid up and dismantled, and the *Wanderer*. She was built at Mattapoisette in 1878. Her tonnage and dimensions were 288 tons net; 116 ft. long; 27 ft. beam; draft, 16 ft. Her crew ordinarily numbered 32 men.

On August 27, 1924, the *Wanderer* was lying at anchor waiting to begin her last voyage south in search of sperm whales when a West Indian hurricane came up the coast and blew her on the Cuttyhunk Rocks in Buzzard's Bay, and she became a total wreck.

A model of convenient size can be made on a scale of 1/6 in. equals 1 ft. of the original. The model illustrated has been somewhat simplified, and certain slight concessions in scale have been made to save the beginner unnecessary trouble. In measurement the model is 19 in. long on the water line, 20½ in. long from one extreme end of the hull to the other, 27½ in. long over all, and 4½ in. in beam.

Before proceeding to work, it will be necessary to have full sized drawings of all parts. These can be obtained by sending one dollar to the Blueprint Service Department of POPULAR SCIENCE MONTHLY for Blueprints Nos. 151, 152, 153, and 154 (see page 110). A list of the necessary materials is given on page 78.

For the hull you will need five pieces of pine, ¾ in. thick, 4½ in. wide, by 20 in. long. On each of these mark a long center line and the construction lines 1 to 9, as shown on Blueprint No. 151. Then transfer to each piece one of the lines given on the half-breadth plan at the top of that blueprint. Do this on both sides of each center line. Be sure to choose a clear, straight-grained piece for top lift *E*, which forms the deck.

Saw and shave these pieces—or lifts as they should now be called—down to the lines and, if you wish, cut out the middle of lifts *B*, *C*, and *D* to within about ¼ in. of the outside size of the pieces below each. This will give you a partly hollowed model which will be lighter and less likely to warp open at the seams than a solid hull. For convenience, draw the construction lines over the edges of the lifts so that you can keep them lined up. Then glue the lifts together so that the construction lines coincide.

From the body plan, which also appears on Blueprint No. 151, make a set of cardboard templates. Fasten the glued-up hull block to the bench or vise by screwing a block of wood to the deck face, with the screw holes where they will be covered; or hold the glued-up hull in any other way that will provide a steady support.

Proceed to shave away the projecting corners of the lifts, taking long cuts, until the templates fit the hull at their several stations; that is, at points 1, 2, 3, and so on. Each template should have marked on it the position of the upper edge of lift *C*, which can be transferred directly from the body plan. These marks will serve as a guide for height. The templates should be held vertical and at right angles to the center line.

A spokeshave is an excellent tool for this job, and a fine wood rasp will be found useful at the ends, especially under the stern. Before the ends can be finished, templates of the stem and stern shapes must be made and the wood cut to fit.

Now fasten the hull upright and shave down upper lift *E* to the deck line shown on the sheer plan. The deck is one curved sweep from end to end, with a camber; that is, the center of the deck is about ⅛ in. higher than the line shown, which is the edge. When this has been sanded smooth, mark the deck planks with a hard, sharp pencil in fore and aft lines a trifle less than 3/32 in. apart.

Next the keel, stem, and sternpost should be made and fastened on. These will all be 3/16 in. thick and of the widths shown on the sheer plan. Any kind of scarf joint may be used to join them, but the easiest way is to let the stem and the sternpost come down level with the hull and bring the keel right under them. Then cut them to the desired shape and fasten in place with nails.

SIMPLE INSTRUCTIONS *for* BUILDING

The notch in the top of the stem is for the figurehead to rest on. If you do not wish to undertake making a figurehead, then finish off the stem with a curl as shown in dotted lines on the sheer plan. Note that the rudder trunk cuts into the sternpost at the top.

For the bulwarks prepare two pieces of wood about 1/16 in. thick, 2 in. wide and 21½ in. long. Lay these outside the hull and mark the sheer of the deck; cut away to this line, but make the rise at the bow a trifle less so that when in place the bulwarks will flare out.

Now cut two strips about 3/32 by 11/64 in. in cross section. Nail and glue these on the deck, keeping them back from the edge a distance equal to the thickness of the bulwarks. This will form a sort of angle or rabbet into which the bulwarks may be glued and lightly nailed. Bring them together at the stem and there support them with a knee shaped as shown in the lower group of drawings on page 78. The forecastle deck also will give them support. At the other end fasten the stern bulwark and reënforce the joints with substantial upright timbers in the corners. Shave down the top of the bulwarks until they are about 11/16 in. deep, being careful that you give them an even, gradual sweep.

At intervals of about 1¼ in. on the waterways, glue timberheads to the insides of the bulwarks. These are about 1/16 by ⅛ in. in cross section. Some of these may well have pegs at their lower ends to go into holes drilled for them in the waterways. Cut the tops of these timberheads level with the bulwarks.

Cut two hardwood strips 3/32 by 11/64 in. to extend from the house aft to the timberhead abaft the cathead. Notch this for half its depth to fit on the timberheads at a position one third down from the top. Glue and nail it through to every other timberhead. This is the pinrail.

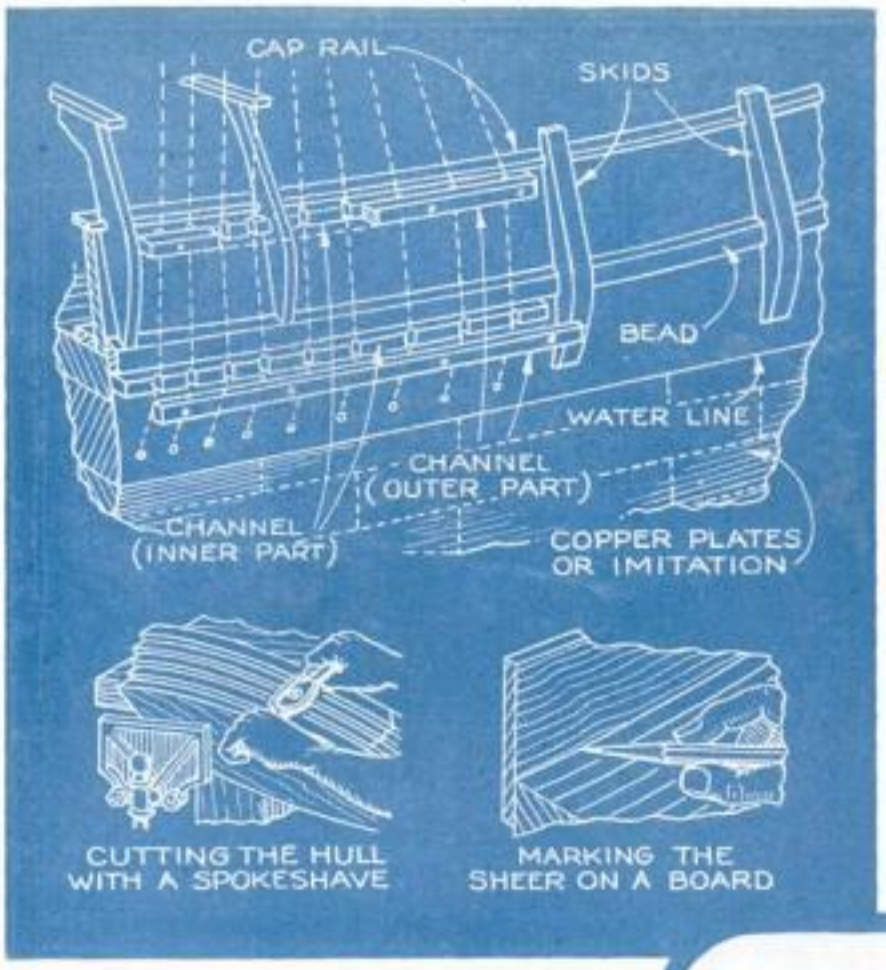
For all this small nailing, ½-in. bank pins are convenient to use. A hole should be bored for each pin with a fine drill or a needle sharpened to a V-shaped edge at the butt of the eye. Wherever gluing is mentioned, nailing also should be done, as far as practical.

The knee previously mentioned, which supports the bulwarks at the bow, may be a piece of hardwood as illustrated, or merely some wood composition pressed into place, since it is hidden below the forecastle. The latter is a thin piece of wood extending to each bulwark as shown. Through it pass two posts, which are set into the deck: these are placed on each

A remarkable view of Capt. McCann's model. It looks to be very large, but actually it is of the dimensions mentioned in the text and shown full size on Blueprints Nos. 151, 152, 153, and 154

Unloading casks of sperm oil. This is a movie representation of a scene once common in New Bedford and other seaports. The arrival of a whaler after a long cruise was a great event

a PICTURESQUE MODEL *of a* WHALER



Shaping hull, marking one of the bulwarks, and (above) skids, channels, and other parts

side of the bowsprit and help to support it.

When everything is set in the bow, bore a ¼-in. hole through the bulwarks and the forecastle for the bowsprit. This may be done most easily with a knife.

The cap rail is a strip 1/16 by 3/16 in. that goes right around on top of the bulwarks to cover the timberheads, to which it is nailed. It should project slightly on the outside, and is cut away to let the catheads rest solidly on the bulwarks. The catheads, which also are shown in the lower drawings on this page, are shaped

Hull Details of Whale Ship *Wanderer*

pieces of hardwood set over the waterways and into the deck, with the grain horizontal — unless a piece of wood can be found that has the grain bent naturally to the right form like a grown knee.

On the fore side of each cathead there are bolts for three deadeyes and a short piece of small chain hanging down, the purpose of which is to be passed through the ring of the anchor and carried around a short bar abaft.

On the outside of the hull glue a strip or bead ⅛ by 3/16 in. to cover the joint of bulwark and hull; this acts as the rubbing strake.

On the starboard (right) side fasten two upright pieces of about the same dimensions to act as skids, as shown in the upper group of drawings (at left) and on the blueprints. These should be notched to fit over the bead which represents the rubbing strake. By rights the bulwark between these skids should be made of loose planks to unship and should have no pinrail. In the positions shown in the same drawings, fasten on the inner parts of the channels.

Bore a hole for the rudder trunk as indicated, and make and fit the rudder according to the detail drawing. The straps for the pintles and gudgeons are strips of brass. Pins are soldered into the rudder straps, and loops to receive them are set into the sternpost straps; but pins alone may be bent to serve.

In the bow bore hawse pipes to come out on the deck just before the windlass, as shown in the deck plan on the blueprints. These should have a rim worked around them and be painted red inside. At the positions shown there should also be holes for the mooring ropes.

The figurehead is an eagle standing on the stem with his wings lying back on the hull. This can be carved from boxwood or built up with some plastic material.

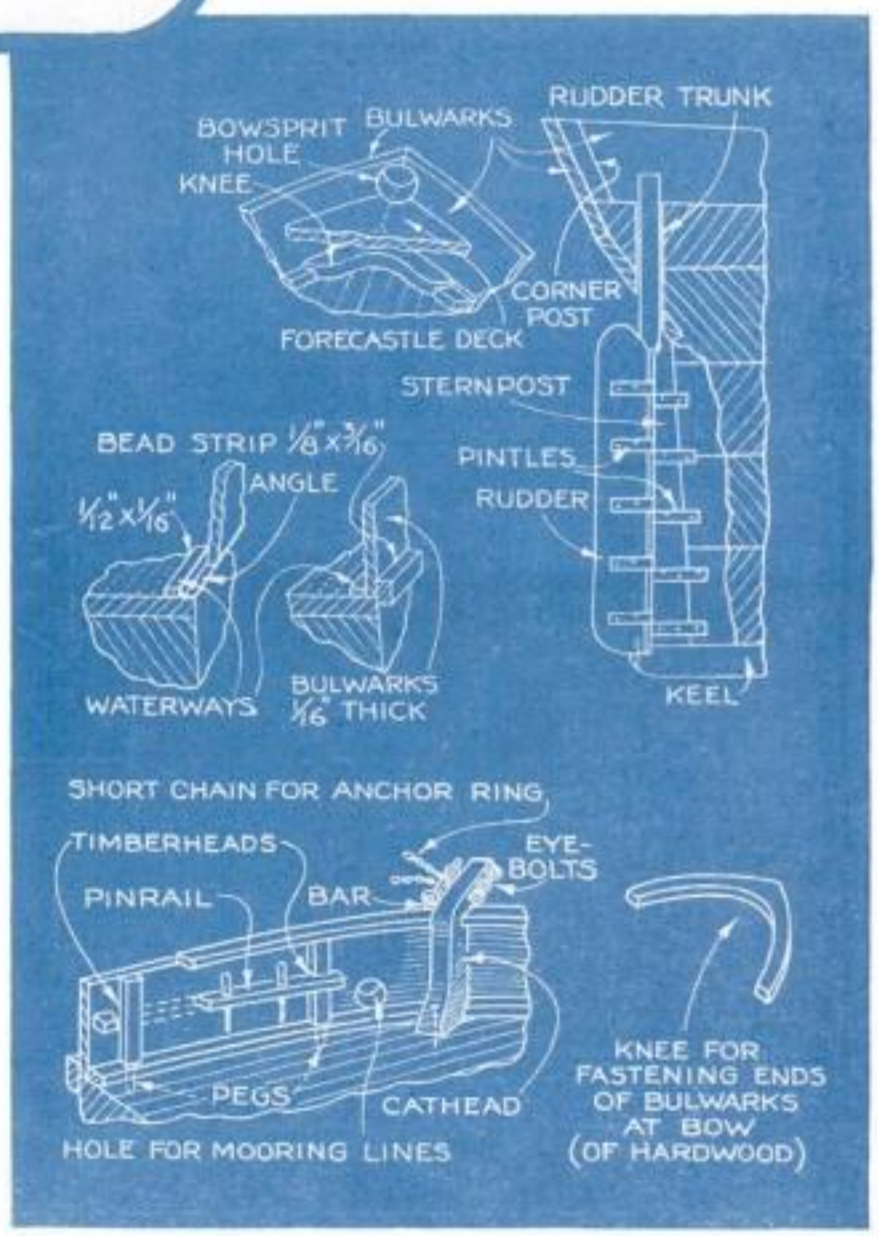
The real hull, up to the water line, was covered with copper plates. This can be imitated with paper-thin (shim) copper glued on, or with paint. Above this the hull is all black excepting the strake at the deck line, which is white. On the bow the name is painted; and on the stern, the name and port of registry. The deck should be given one coat of varnish.

Next month the construction of the deck furnishings will be described.

WHAT MATERIALS YOU WILL NEED

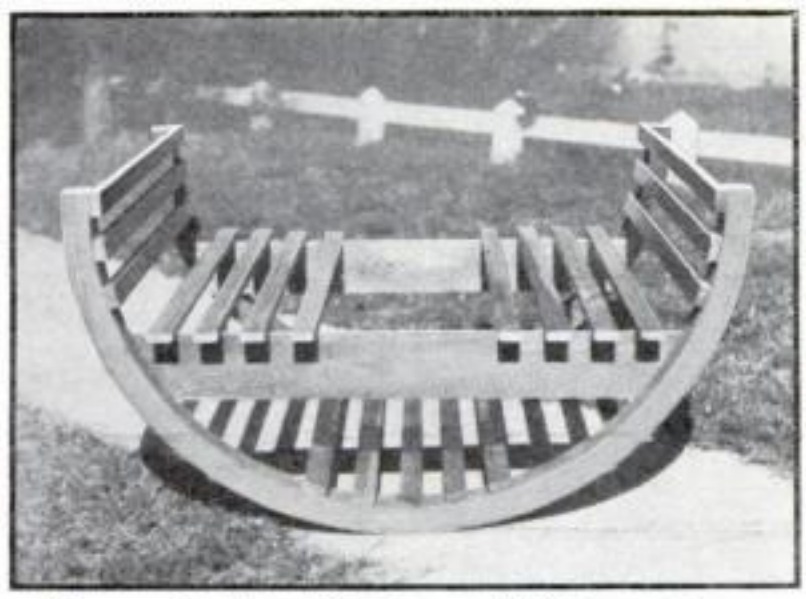
5 pc. ¾ by 4½ by 20 in., clear white pine
1 pc. 1/16 by 12 by 24 in., maple, birch, or other hardwood.
1 pc. 3/16 by 6 by 24 in., maple, birch, or other hardwood.
1 pc. 3/32 by 6 by 9 in., 3-ply birch or whitewood, if obtainable; otherwise any hardwood or several thicknesses of thin veneer glued together with the grain of one piece at right angles to that of the next.
1 pc. 2 by 4 by 24 in., clear white pine.
1 pc. ¾ by 6 by 24 in., maple or gum.
1 pc. 5/16 by 5/16 by 3 in., boxwood.
1 pc. 3/16 by 3/16 by 18 in., boxwood.
1 pc. ⅛ by ⅛ by 18 in., boxwood.
2 pc. 5/16-in. birch or maple dowels, 3 ft. long.
3 pc. ¼-in. birch or maple dowels, 3 ft. long.
2 pc. 3/16-in. birch or maple dowels, 3 ft. long.
Sheet brass, 3 by 4 in., No. 24 gage (B. & S.).
Copper sheathing, 4 by 44 in., between .0015 and .003 in. thick (copper shim). Copper paint can be used instead.
Wire: 10 ft. No. 22 copper; 5 ft, No. 24 copper; 40 ft. No. 28 half-hard brass; 6 ft. No. 20 half-hard brass; 3 ft. No. 10 soft copper (for making anchors, winch, etc.).
Sheet celluloid, 3 by 4 in., ⅛ in. thick, clear or white.
Twisted linen fishing line: 24 ft. of a diameter equivalent to No. 18 (B. & S.) gage wire; 36 ft. equivalent to No. 20 wire; 60 ft. equivalent to No. 24 wire; and 90 ft. equivalent to No. 30 wire. (All the heaviest line, 33 ft. of the second line, 15 ft. of the third line, and 50 ft. of the fourth or thinnest line should be dyed black.)
Thread: 1 spool of A black silk; 1 spool of No. 70 black sewing cotton. ¼ lb. of ½-in. bank pins and 5 doz. ⅜-in. No. 20 escutcheon pins. Muslin, 1 sq. ft.
Chain: 70 in. with about 18 links an inch, and 40 in. with about 13 links an inch.
Paint: Black, white, burnt sienna, red, artists' oil colors; gold; (copper shim).

Below: **Method of erecting bulwarks; timberheads, catheads, rudder, and various details**



THIS ROCKER KEEPS CHILDREN HAPPY

A "JOLLY ROCKER" built like the one illustrated will give children many happy hours. It is perfectly safe because even the most violent rocking will not cause it to tip over, and it is strong enough to defy the destructive efforts of a whole gang of youngsters.



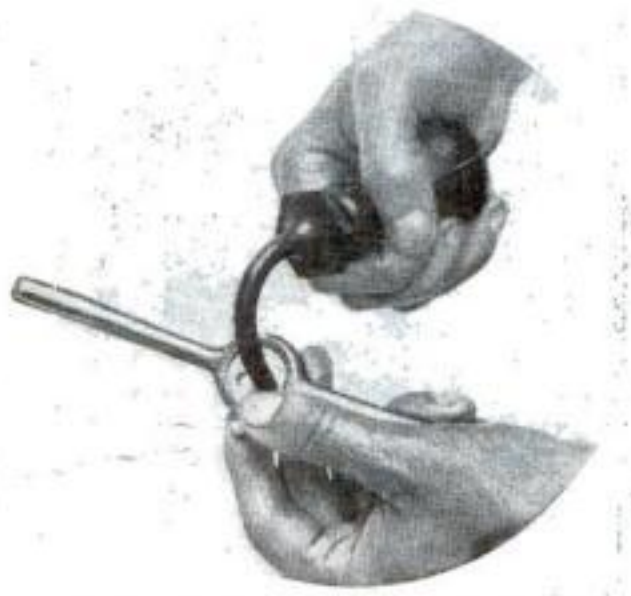
The curved members of the frame of this large rocker are ordinary wagon wheel felloes obtained from a blacksmith

Two wagon wheel felloes are required for the rockers. I bought these from a blacksmith for $2. The ¾ by 2 in. strips for flooring, seats, and backs and the ¾ by 6 in. sidepieces were obtained at a lumberyard for 80 cents. This was in one of the larger cities of Florida; in many parts of the country, especially in rural districts, the cost would probably be about the same, while in other parts the materials would not be so reasonable. However, scrap lumber will serve the purpose just as well, if available, and the dimensions, of course, do not have to be exactly those mentioned.

The felloes are 2 by 3 in. in cross section and 4 ft. in diameter. Across them I nailed the floor strips and the backs of the seats. The sidepieces were nailed on next, and on top of them, the pieces for the seats themselves. All the strips with the exception of the sidepieces were cut 4 ft. long, thus making the jolly rocker wide enough to hold grown-ups.

After the last nail was driven and I stopped to survey my work, my neighbors' children realized that the jolly rocker was finished, and they all piled in. That happened two weeks before this is being written, and the rocker isn't painted yet! I had intended to paint it green—and will when I find it empty long enough to get out paint and brushes. Penny for penny, there is hardly anything that will give children more real satisfaction and safe fun.—CHARLES H. ALDER.

RUBBER BLOWER CLEANS CHIPS FROM TOOLS



Using a hydrometer bulb and tip to blow the chips out of a small threading die

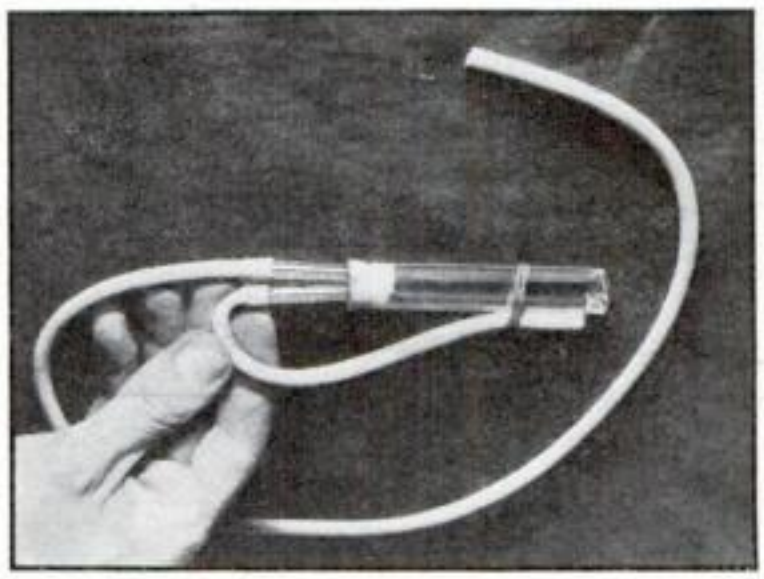
IF ONE has access to an air blast, it is not difficult to free small dies and other tools from fine chips and cuttings. At the home workbench, an equally effective method of cleaning small tools may be used simply by obtaining a hand bulb and tip for a hydrometer at a ten-cent store. The base of the tip in that type which is ordinarily sold will fit snugly into the hole in the bulb, forming a powerful air-blast syringe. The tip can be bent to any angle and will enter almost any variety of small hole.—B. N. T.

STRAIGHTENING WIRE WITH AID OF HEAT

TO REPLACE a small shaft in a flashing device, I needed a piece of wire .096 in. in diameter. I had a coil of music wire of this diameter, so I cut off a piece about 2 ft. long, suspended a 5-lb. weight from one end, and ran a torch up and down the wire. This left it straight, and at no place was the diameter smaller than .0001 in. undersize.—HAROLD C. BLAIR.

SELF-STARTING SIPHON EMPTIES TANKS

FOR draining aquariums or other liquid containers, you will find a self-starting siphon useful. To make one, obtain a small glass bottle or vial, a rubber cork to fit, two pieces of glass or metal tubing about 2 in. long, and some rubber tubing that will fit snugly over these pieces. Bore two holes in the cork, insert the short metal or glass tubes, and over one slip a piece of rubber hose just long enough to reach the bottom end of the bottle when it is bent over and bound to the side with a rubber band as illustrated. Over the other projecting tube attach a section of rubber hose long enough to drain the tank. To start the siphon, lower the bottle into the water or other liquid and let it fill. Then lift it out for a few seconds while some of the liquid runs into the longer tube. Return it, and the liquid should start flowing within a few seconds. If it does not, repeat the operation. An experiment or two will teach you just how to manipulate the siphon. It is possible to make this device, of course, in any desired size.—W. E. B.



This siphon, which is particularly useful for draining aquariums, requires no suction to start the flow

Making Moccasins

FOR YOUR NEXT VACATION

. . . The softest and most comfortable of all footwear

By LEONARD F. MERRILL

MOCCASINS! Footwear of the American Indian, they have been worn by nearly all the great hunters, woodsmen, and scouts of American history or fiction. That is because they are the softest, easiest foot covering ever designed.

To make a comfortable and serviceable pair of moccasins for your coming vacation requires no special tools or skill, and the materials are not expensive.

Materials. High-grade oil-softened leather about 15 by 20 in. and at least ⅛ in. thick; 1 pair rawhide laces 54 in. long; thin cardboard about 8 by 15 in. for making the pattern.

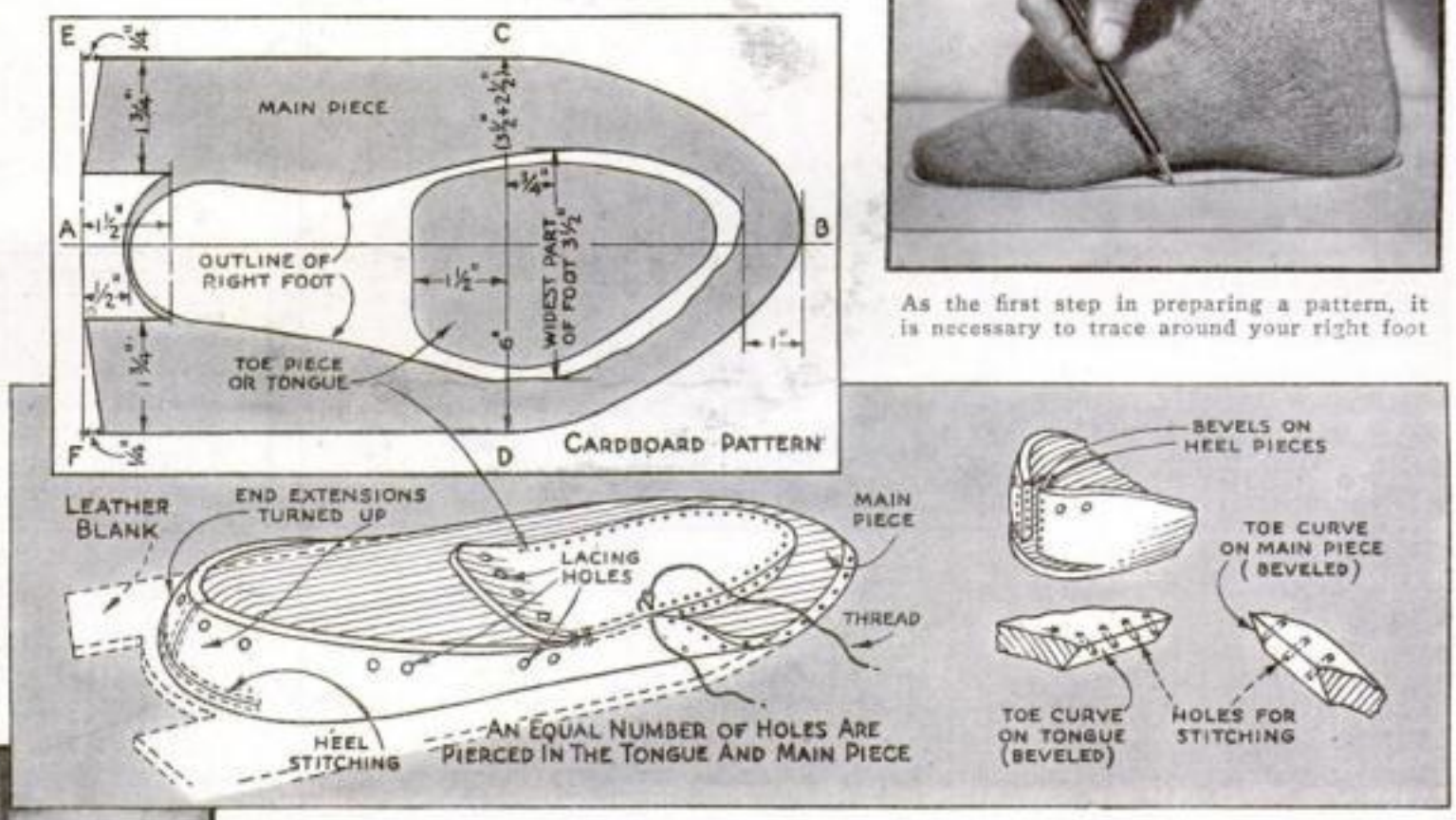
Tools. A sharp knife, a punch for making holes for the laces, an awl, a heavy needle, and some five-cord waxed linen thread. A combination sewing tool—awl, needle, and bobbin of thread in one handle—is a convenience.

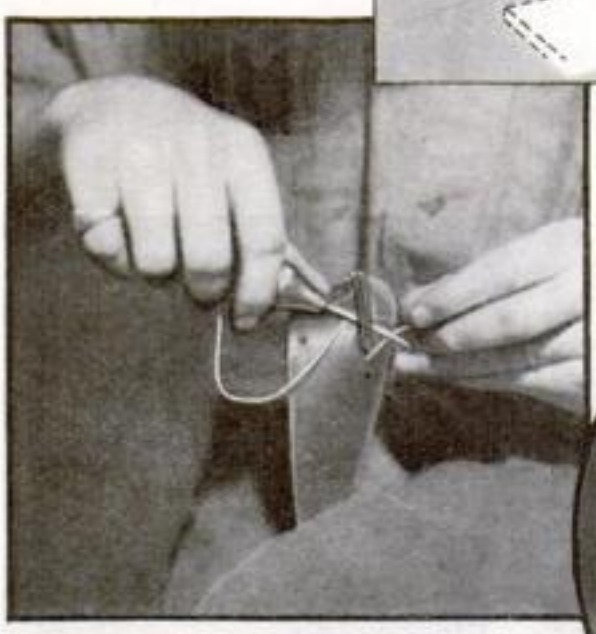
Pattern. Trace around right foot on cardboard. Wear a heavy sock such as is used with golf clothes. Draw a line *AB*, as shown in the pattern drawing, from the center of the heel curve to the center of the second toe. Draw two lines at right angles to this line—one *CD* ¾ in. back of the widest part of the foot and the other *EF* ½ in. behind the heel curve. Measure the widest part of the foot and then add 2½ in. to it. Point off distances equal to one half of this measurement on *CD* and *EF* each side of the center line. Connect these points with straight lines. Extend the center line 1 in. beyond the toe. Draw a neat, full curve from this point to the ends of the two straight lines just drawn.

The heel is designed by measuring 1¾ in. from the outside lines toward the center on the heel *(Continued on page 113)*

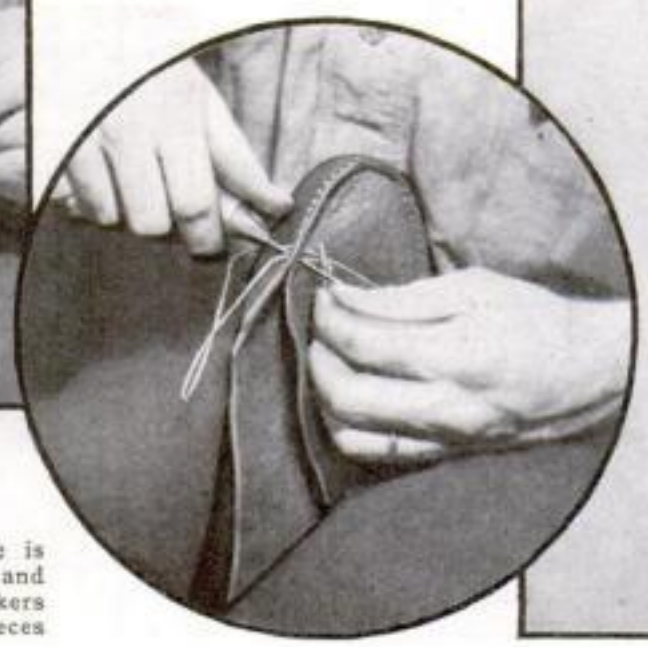
As the first step in preparing a pattern, it is necessary to trace around your right foot

How the pattern is drawn after you have a tracing of your right foot; and sketches showing the way the heel is stitched up and the tongue sewed in

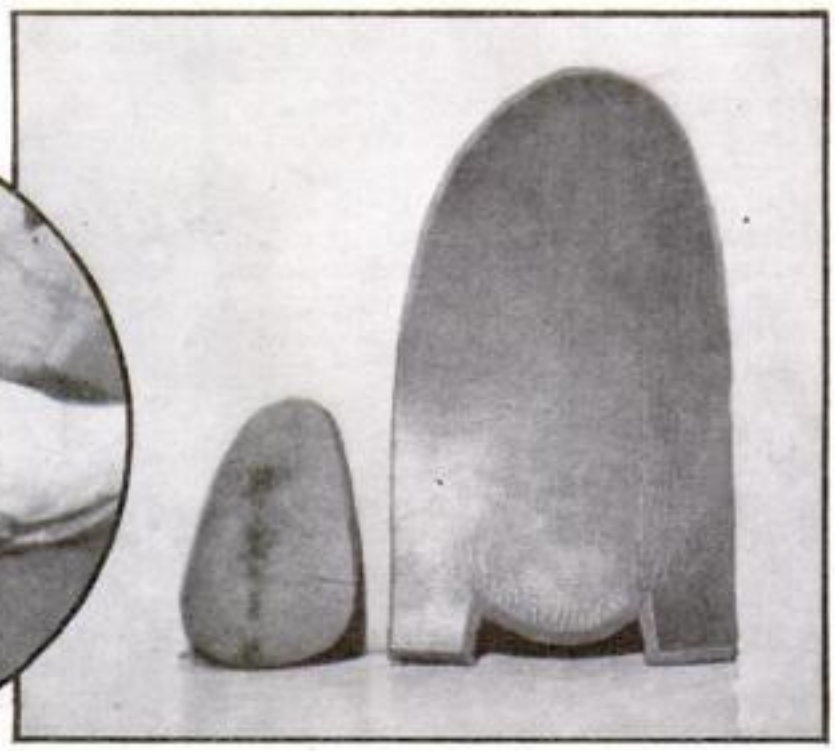




Stitching up the heel. A simple type of lock stitch is used. The steps in making it are shown in diagrams on page 114



As shown in the circle, the tongue is stitched in by starting at one end and working around. The toe then puckers into shape. *At right:* The two pieces



April 1932

A Ready-to-Assemble

BOOK TROUGH

Made from Solid Mahogany and Complete Even to the Finishes

FOR its April project, the Popular Science Homecraft Guild is offering a construction kit with which to assemble a genuine mahogany book trough of exceptional grace and delicacy—the equal of the finest custom-built furniture in design and quality.

From the standpoint of cost, this kit represents another remarkable achievement by the Guild in its efforts to make it easier and less expensive for readers to take up the hobby of building furniture at home.

The Guild will send you, shipping charges prepaid, the complete kit for this beautiful little piece of furniture for $5.30. The kit includes the wooden parts, all machined with a clean-cut precision and perfection that will amaze you; the necessary dowels, screws, and plugs; three cans of the new Guild finishes, which are superior to anything heretofore prepared for amateur use; and cheesecloth for making finishing pads.

For your convenience in ordering, a coupon is given on page 107, but if you prefer not to cut the magazine, you may order by letter. The price is the same whether you send a remittance with your order or have the kit delivered C. O. D., but the first method is simpler, speedier, and generally more satisfactory. All Guild kits are sold with an absolute money-back guarantee.

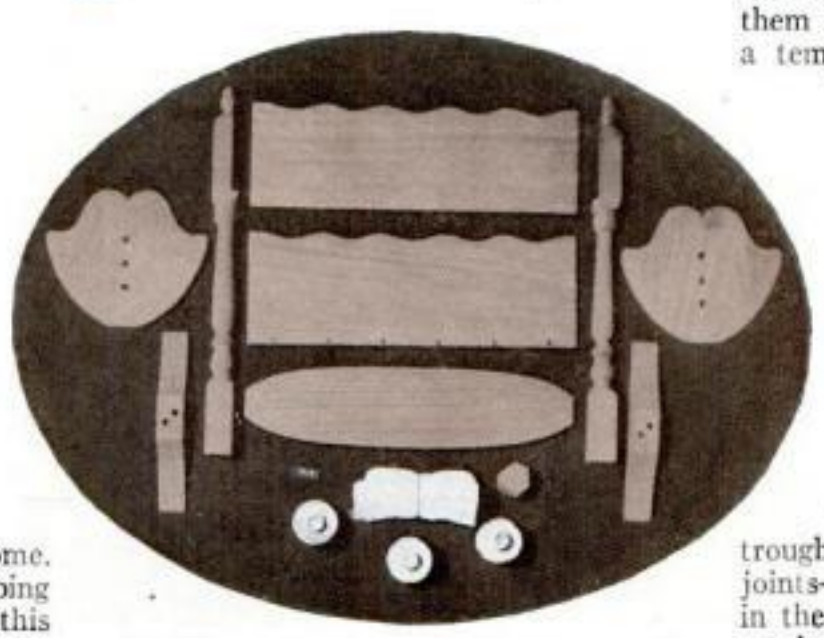
The book trough is 22½ in. long, 9½ in. wide, and stands 24¾ in. high over all. To assemble it you will, of course, need a few tools; these will be referred to as they become necessary in the following instructions. Other essentials are a few sheets of Nos. 1 and 00 sandpaper; a little No. 000 or very fine steel wool; some casein (cold water) glue or cabinetmaker's hot or hide glue, according to personal preference; and two or three 1½-in. fine bristle paint brushes for applying the finishing materials.

In the kit, when you receive it, you will find the following wooden parts: 2 turned legs, 2 shaped feet, 2 shaped trough ends, 2 shaped trough sides, 1 shaped stretcher shelf, and 6 cross-grain plugs to conceal screw heads. All these are of selected mahogany. The parts are practically ready for assembly with the dowels and screws provided. You will find that the dowels are of several different diameters and lengths, depending upon where they are to be used. The dowels which fasten the sides of the trough to the ends, for example, are considerably longer than the dowels that join the lower edges of the two trough sides. Take the time to try them in the various holes; in fact, make a temporary set-up of the book trough without glue in order to see just how the parts go together.

Take the trough apart, remembering where the dowels go, and then round off the edges of the trough ends with a file or fine rasp and sandpaper to match the upper edges of the trough sides, which have been rounded by machine. Then sandpaper these trough sides sufficiently to soften the machine-rounded edges until they have a handmade look.

The next step is to glue the trough sides together. The secret of gluing joints—provided they are perfectly made in the first place, as these are—is to use good glue, have everything ready, apply moderate pressure, and then leave the parts undisturbed until the glue is dry, depending upon what kind has been used.

The two sides *(Continued on page 106)*

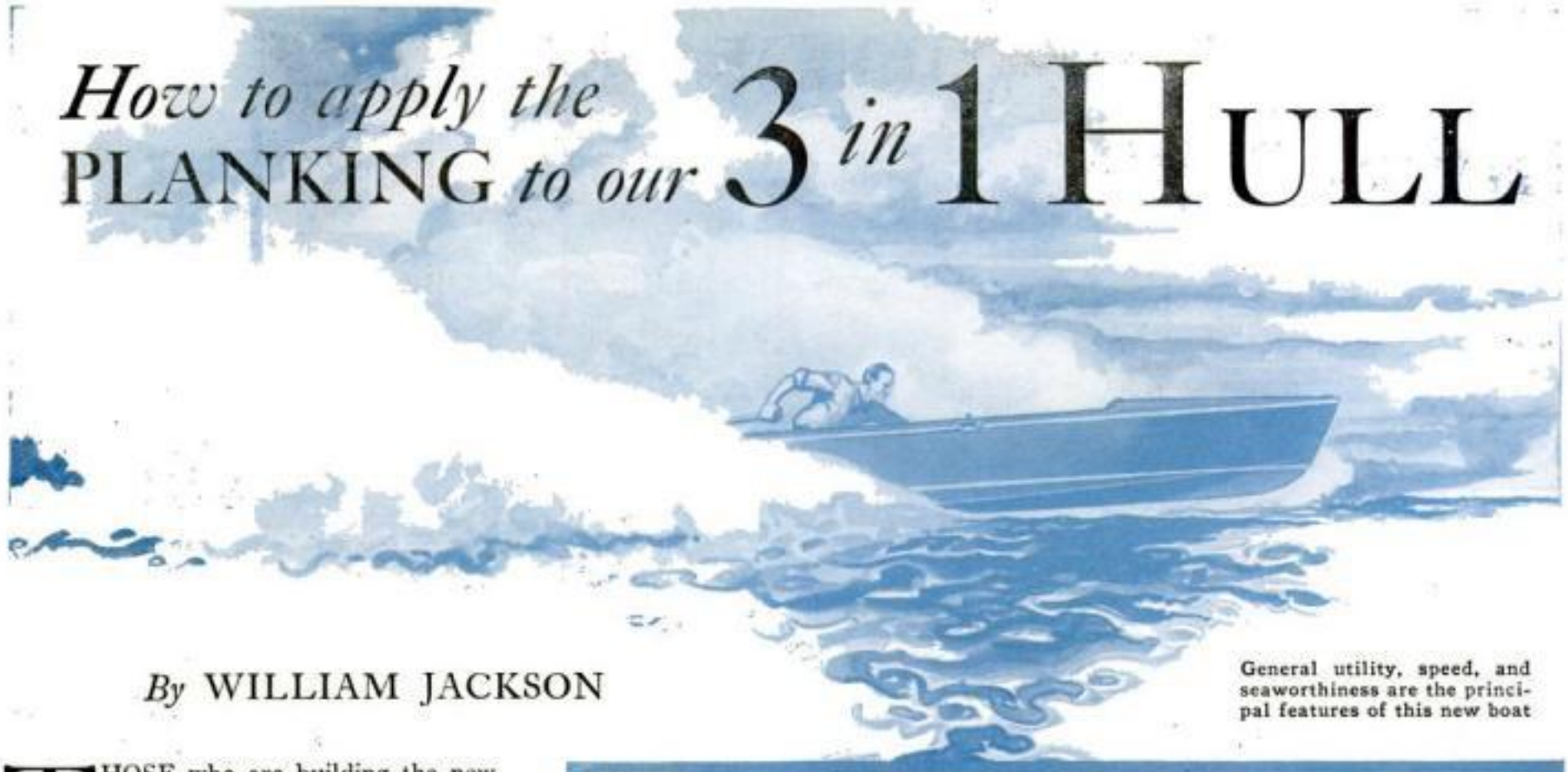


The kit contains the machined parts as well as dowels, screws, finishes, and cheesecloth

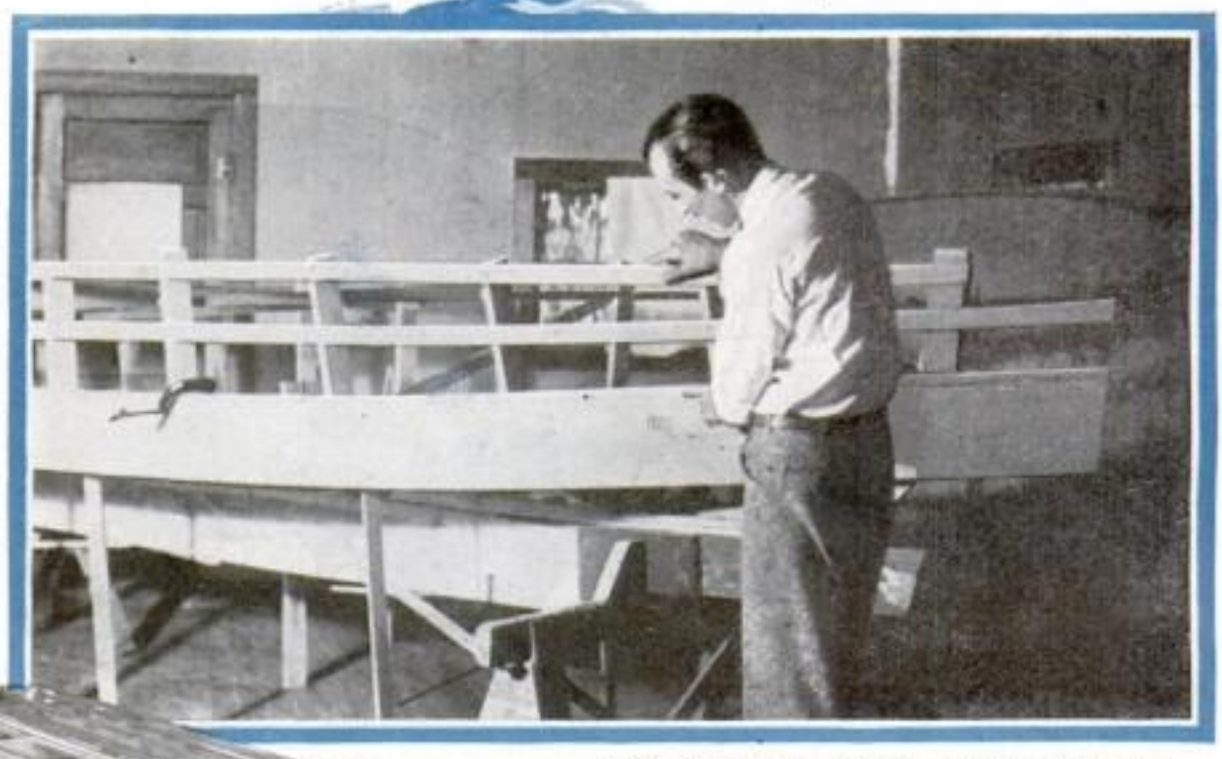
Designed and Guaranteed
by the
POPULAR SCIENCE
HOMECRAFT
GUILD

Side and end views of the assembled piece, which is of the finest Honduras mahogany so finished as to bring out the full beauty and richness of the wood. The trough parts are glued and doweled together, then screwed to the legs. The shelf is doweled

How to apply the PLANKING *to our* 3 *in* 1 HULL



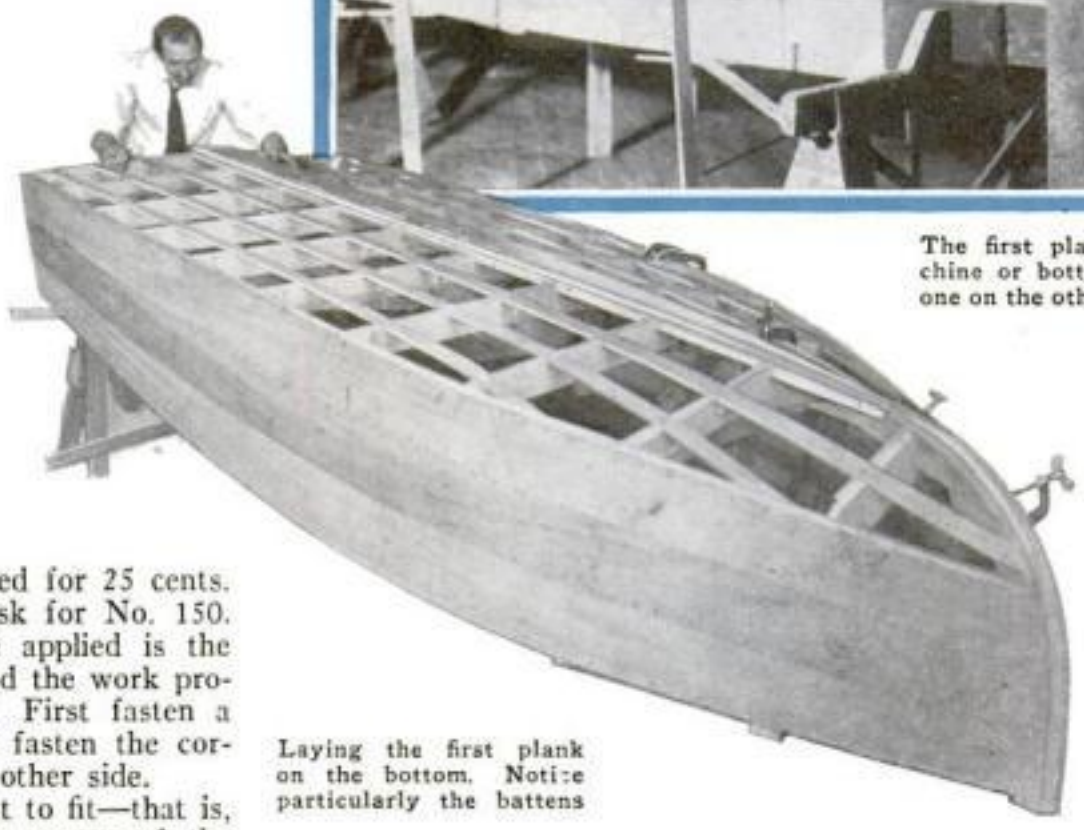
By WILLIAM JACKSON



General utility, speed, and seaworthiness are the principal features of this new boat

THOSE who are building the new POPULAR SCIENCE MONTHLY three-in-one boat *Vagabond* and have faired the framework as described at the end of last month's article (P.S.M., Mar. '32, p. 75) are ready to begin planking the hull.

If you missed that article and wish to construct one of these inexpensive but fast and seaworthy little boats, you can obtain a blueprint with complete working drawings for 25 cents (see page 110). Blueprint No. 147 is for a hull 13 ft. long with a beam of 4 ft. 6 in.; Blueprint No. 148, for a hull 14½ ft. long, 4 ft. 8 in. beam; and Blueprint No. 149, for a hull 16 ft. long, 4 ft. 8 in. beam. The design is the same in each case, and any of the boats may be rowed or used with an outboard motor. Furthermore, the hull can be adapted for use with a small inboard motor, placed aft and equipped with one of the new stern drives that promise to be so popular. The details for making this conversion are given in a fourth blueprint, which also can be obtained for 25 cents. In ordering this print, ask for No. 150.



Laying the first plank on the bottom. Notice particularly the battens

The first plank applied is the one at the chine or bottom; next is the corresponding one on the other side; and so on to the inwale

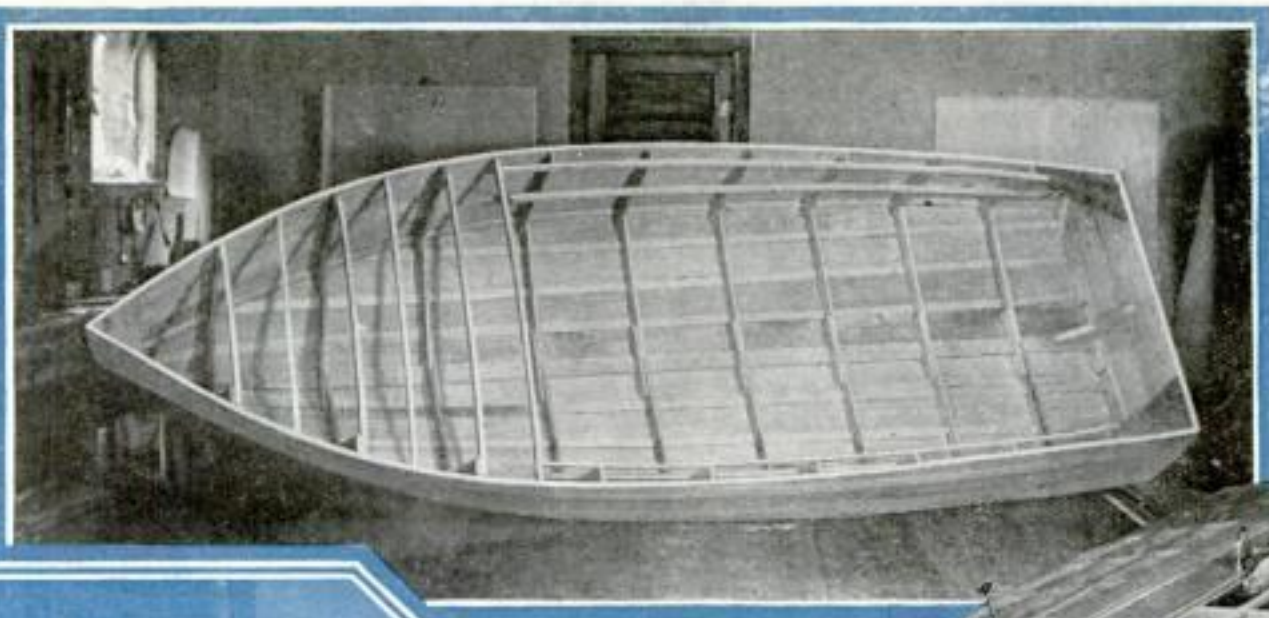
The first plank to be applied is the one nearest the chine, and the work proceeds up to the inwale. First fasten a plank on one side; then fasten the corresponding plank on the other side.

Each plank must be cut to fit—that is, to make a joint—in the center of the battens. An easy method to do this is to clamp the plank in place, mark along the underside of the batten, then add half of the width of the batten to this measurement. Another way is to use a "spiling batten"—a long strip about ¼ in. thick and 3 in. wide. Lay this along where the measurement is to be taken (whether this is the edge of a plank already placed or the center line of a seam batten). At intervals of 1 ft. take any convenient measurements from the edge of the plank (or the center of the batten) to a point which you mark on the face of the spiling batten. Once you have laid out this series of points on the spiling batten, it is an easy matter to lay the batten alongside the board from which the new plank is to be cut and mark it to correspond. A light strip which will bend readily may then be used in drawing a curved line passing through the various points.

Before fastening the planks, coat the transom and chines with marine glue. Begin to fasten the planks at the stem and work back. Screw the planking to the keel, frames, chines, and stem with 1¼-in. No. 6 flathead screws spaced 2½ in. apart. Along the battens and inwales use 1-in. copper clout nails at 2½-in. intervals.

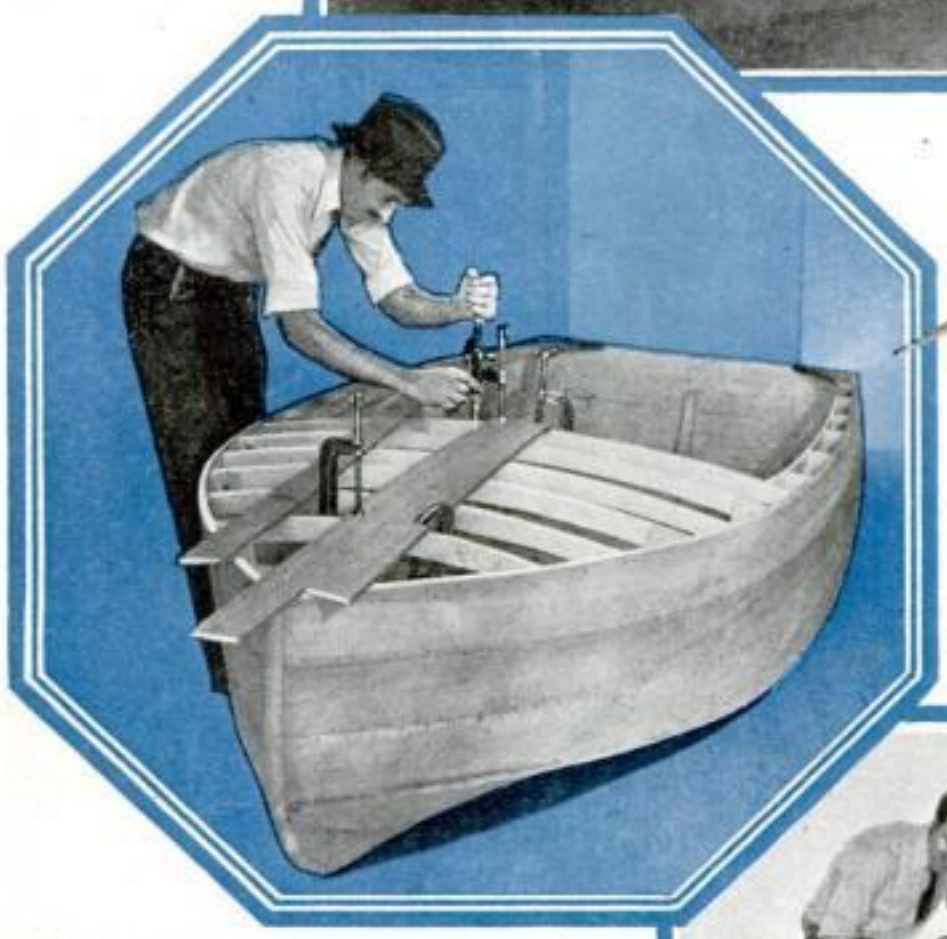
When the sides have been planked, remove the hull from the form, turn it upside down, and trim and fair the bottom frames. Bevel off the keel and screw the filler piece to the keel with 1¼-in. No. 6 flathead screws spaced about 6 in. apart.

Divide and mark the space on the frames between the filler piece and the chine into four equal spaces. Fair these with a long batten. Notch battens into these spots as you did with the side battens. Start planking from the keel and work out to the chines, but before fastening the planks, coat the keel, transom, battens, and chines with marine glue and lay

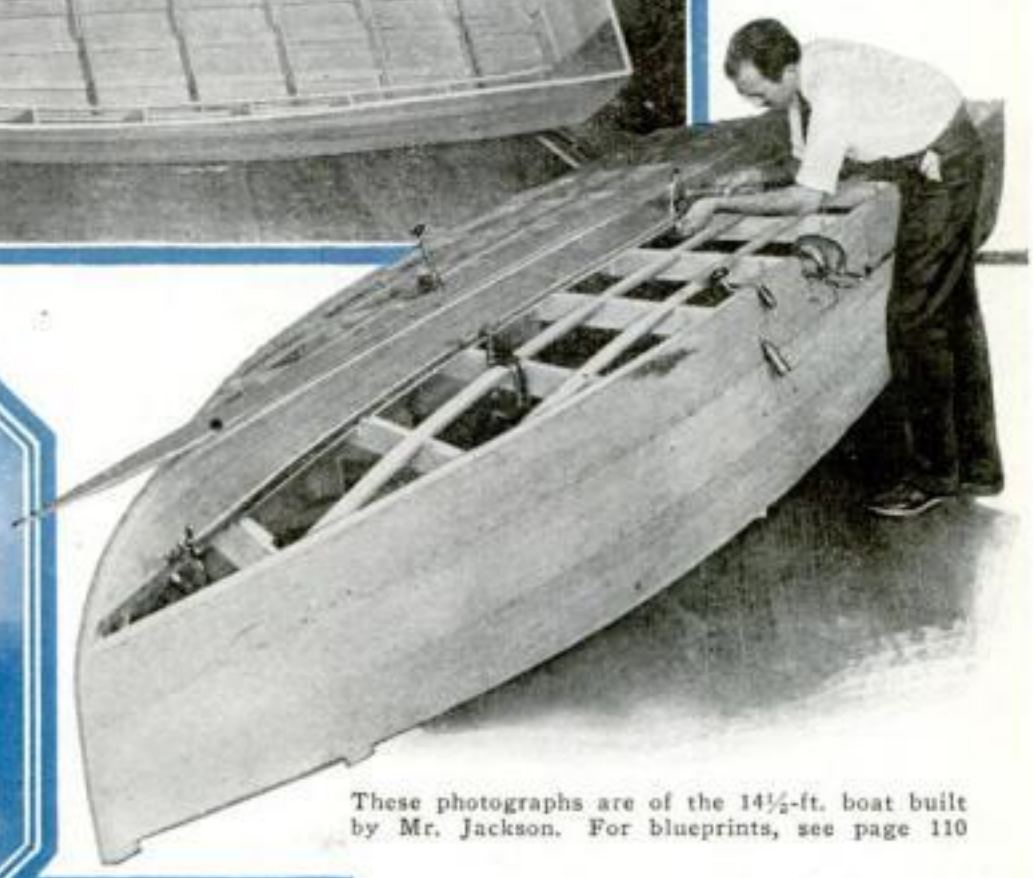


A photograph taken after the sides and bottom were planked. In it can be seen the deck beams and intermediate beams, the corner braces, transom knee, and breast hook, the inside coaming and seat supports

Below is shown how the bottom planking is applied. Marine glue is used on the joining surfaces, and strips of cloth are then placed on the glue. The first planks fastened are the ones adjacent to the keel



The decking is beveled a trifle so as to form a slight V, later filled with seam compound



These photographs are of the 14½-ft. boat built by Mr. Jackson. For blueprints, see page 110

The deck beams are bolted to the frames; the intermediate beams are set in between

cloth on the glued surfaces. Again fasten the planks first at the stem. It will make the bending easier if the forward ends of the planks are wrapped in sacks and hot water is poured over them. Fasten the bottom planks like the side planks, fitting them tightly together.

Secure the transom knee in place with six 2½-in. No. 9 flathead screws.

After the bottom planking is finished, the hull should be turned over and the deck beams attached to the forward frames with one ¼ by 1½ in. carriage bolt at each joint. Lay a light batten over the beams and measure for the intermediate beams, which are fastened to the sides of the hull midway between the frames with two 1½-in. No. 8 flathead screws in each end.

The breast hook is fastened with six 1½-in. No. 8 flathead screws. It projects slightly above the inwale and is rounded off to conform to the rise of the deck. Attach the corner braces to the transom with three 2½-in. No. 9 flathead screws, and to the inwale with four 1½-in. No. 8 screws. The inside coaming should be fitted flush into notches in the top edge of the frames and corner braces and fastened with 1¼-in. No. 6 flathead screws.

The decking and sidepieces or sheer plates are next fastened with 1¼-in. No. 6 flathead screws spaced about 2½ in. apart. The piece used in the center of the deck may be 6 in. wide, with the remainder of the decking 3 in. wide. If thought desirable, ⅜ by 6 in. boards may be used throughout and grooved slightly on a circular saw to represent seams. Bevel the edges of the decking so as to form a slight V about 1/16 in. wide on the outside, and fit tightly together on the underside. The seams may be filled with white seam compound, if desired; this makes a pleasing contrast when the deck is varnished.

Another excellent method is to use pressed wood composition board for the decking. This may be covered with canvas, if desired. Stretch the canvas well, tack it along the sheer, and paint it. Light muslin will serve the same purpose if it is treated with three coats of airplane wing dope and then lacquered.

Fasten the ⅜ by 3 in. outside coaming with 1¼-in. No. 6 flathead screws spaced about 3 in. apart. Secure the seat riser to each frame with two 1¼-in. No. 8 flathead screws. The cockpit end piece, which joins the forward ends of the coaming, is fastened to the deck beam with 1¼-in. No. 6 flathead screws. It should project ¾ in. above the deck.

Build the motor board as shown on whichever blueprint you are following. Screw each angle piece to the board with three 2½-in. No. 9 flathead screws. Bolt the complete motor board to the transom with two ⅜ by 7 in. carriage bolts, placing the bolts as near the top of the board as possible.

The seats, cut to rest on the riser, can be left loose or fastened in place.

Sandpaper the hull smooth, apply the priming coat, and fill all the seams with seam composition. Then paint or varnish the hull carefully, inside and out. Finally, fasten the floor boards and the sheer molding with 1¼-in. No. 6 flathead screws. If you prefer, you may assemble the floor boards in sections so they can be removed.

Those readers who are just beginning to build one of these boats and do not wish to lay out and cut their own full size patterns can obtain a complete set of patterns of the frames, stem, and deck beams for any one of the three boats by sending $1.50 to the Blueprint Service Department. These will be cut from Mr. Jackson's templates.—The Editor.

A HARPOON FOR KILLING DANDELIONS

The working end of the dandelion exterminator. It is a section from an old mower sickle or any steel blade of the same general shape

Because it has so long a handle, the weeder can be used with little effort or backache; and it does not do much damage to the sod

Dug out with everything from a penknife to grandfather's old saber, dandelions continue to grow and thrive. A better tool with which to combat them is illustrated. It is a sort of easily handled harpoon—an old mower sickle section firmly bolted into a slot cut in the end of an old rake or hoe handle. Any suitable piece of steel, of course, may be used to form the blade. The smaller plants can be turned or "flipped" out quickly, along with a goodly portion or all of the young root, yet little earth or sod is disturbed or torn up in the operation. It is a great advantage, also, to be able to do the work in a standing position.—Frank W. Bentley.

TRICK BLINDFOLD TEST FOR CIGARETTES

In this blindfold cigarette trick, the spectators place one each of several different brands of cigarettes on the table. The performer snips strips from a sheet of black paper and gives one strip and one cigarette to each spectator to be "blindfolded" by covering up the brand mark. The performer then identifies each cigarette merely by smoking it.

In his right hand, which also holds the scissors, the performer conceals a prepared set of paper strips, which are exchanged for those he cuts from the black paper. The duplicates have been previously prepared by soaking each in a flavoring solution, then ironed flat. The duplicates are in memorized order, each representing a particular brand of cigarette, and are so paired off when giving the cigarettes to be banded. A touch of his tongue to the black paper band instantly tells the performer the name of the cigarette. The flavorings are made with water as follows: 1, salt; 2, sugar; 3, pepper; 4, citric acid (tart); 5, the plain paper (unflavored).—Kenneth Murray.

ROUND-NOSE PLIERS AID IN OPENING CANS

When the small slotted-wire "keys" that come with some kinds of canned food tear the tin off at an angle, leaving the can only partly open, a pair of round-nosed pliers may be used to finish the job quickly and effectively. Grasp the edge of the torn tin with the pliers, twist them to the right, and the remainder of the can top will roll off the way it is meant to do. It may be necessary to repeat the operation from the other side of the top, but this is easily accomplished and takes but a moment more. The contents of the can may then be removed without damage. Pliers of this type are so useful for this purpose that it pays to keep them handy in the kitchen.—A. V. Comings.

Using round-nose pliers to finish opening a can from which the "key" has broken away

PORTABLE RABBIT HUTCH

This combination rabbit hutch and wire run can be wheeled around as a unit, with the advantage that the rabbits may be moved when necessary to fresh grass and also kept in the shade. The run or cage is covered with 1-in. mesh wire netting and has no bottom, but a bottom of 2-in. mesh could be added if the rabbits tried to burrow out. The hutch is mounted on toy wagon wheels, therefore does no damage to the grass.—A. E. Anderson.

PREPARING IMITATION PARCHMENT

It is a simple matter to convert unsized paper into synthetic parchment for making greeting cards and underlays for mounted photographs, as well as other purposes for which genuine parchment would be appropriate. Prepare a strong solution of sulphuric acid by gradually and cautiously adding concentrated acid to half its volume of water. Make a second and not very strong solution of sodium bicarbonate and water, or ammonia and water. Insert the paper into the sulphuric acid for a few seconds, then plunge it immediately into the alkali bath. After the bubbling has ceased, wash the paper in clear water and let it dry thoroughly before using it for decorative purposes.—Vernon B. Case.

Because the acid used in treating the paper is so strong, do not let any of it touch your fingers, clothing, or table top

April 1932

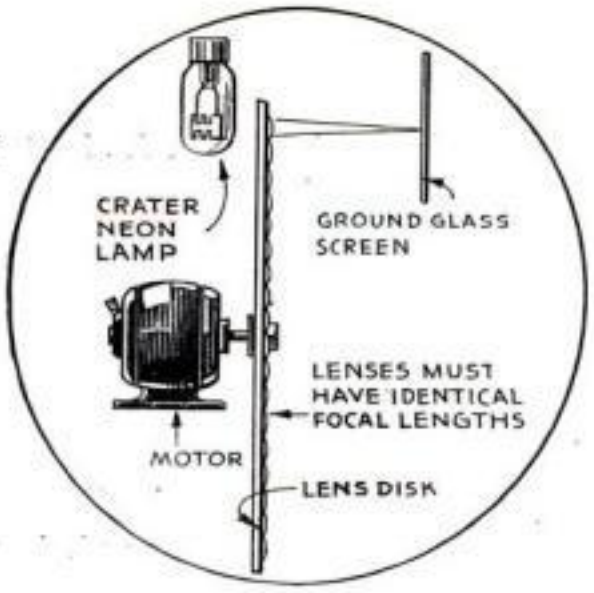
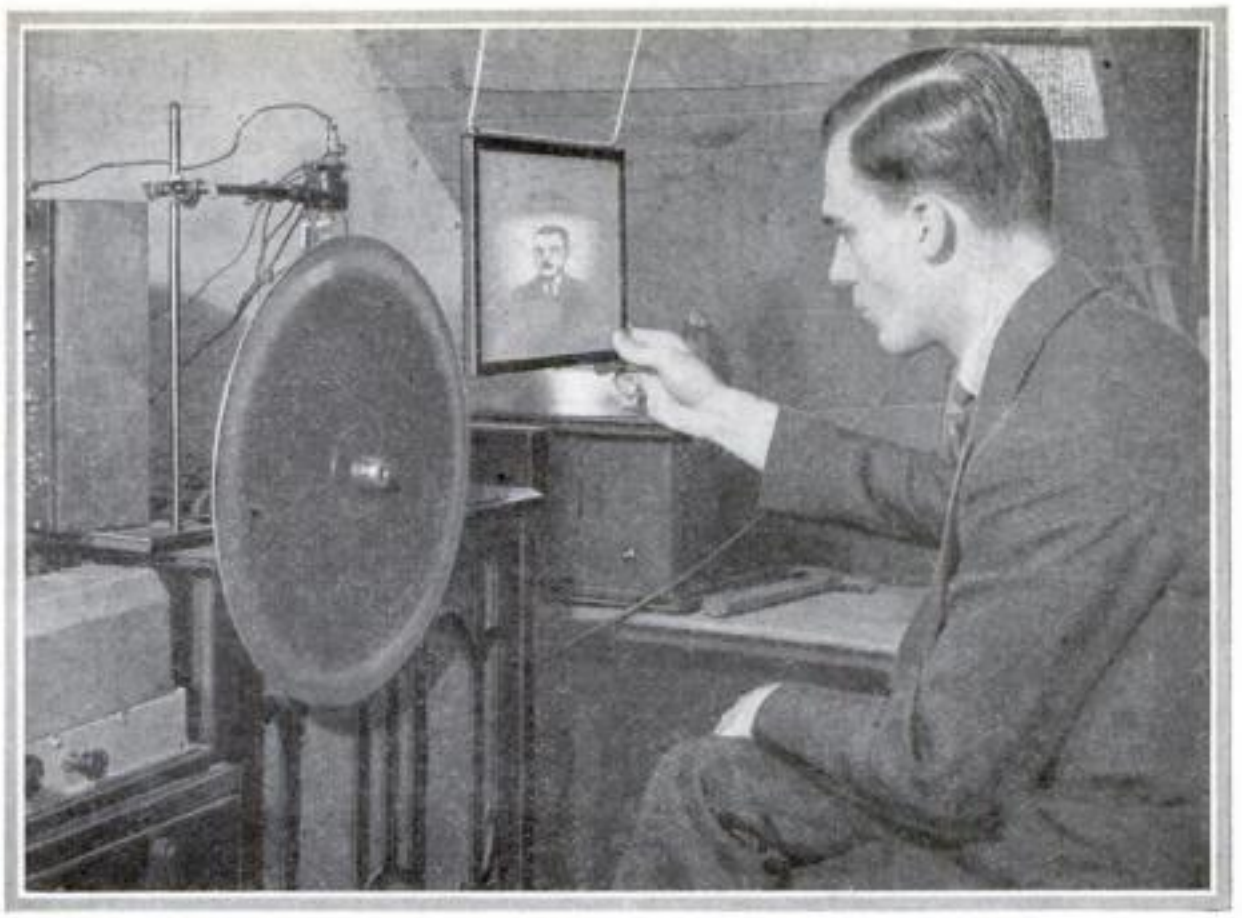


Fig. 1. The author operating a lens disk receiver. *Above:* How parts are arranged



Enlarging TELEVISION Pictures

with a LENS DISK *and a* CRATER NEON LAMP

By GEORGE H. WALTZ, JR.

DON MARSHALL, my neighbor, who is a television experimenter and a radio expert, led me down the stairs to his well-equipped basement workshop.

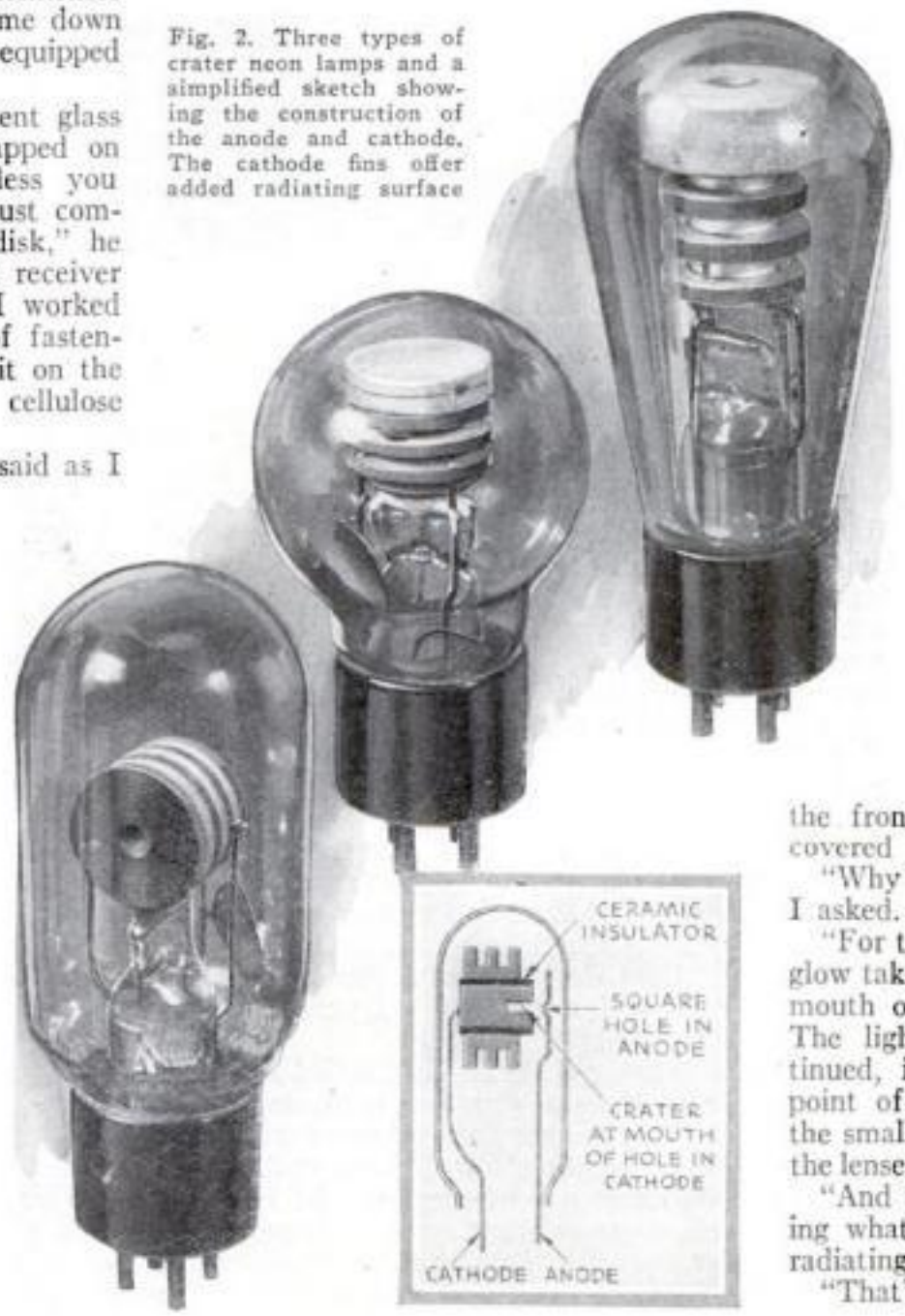
"Have you ever tried to cement glass to metal?" he asked as he snapped on the light. "It's some job—unless you know just how to do it. I've just completed my first lens scanning disk," he added, pointing to his television receiver (see Fig. 1), "and believe me I worked plenty hard over the problem of fastening the lenses in place until I hit on the idea of using a transparent cellulose household cement."

"So that's a lens scanner," I said as I examined the metal disk studded with tiny lenses (see Fig. 4). "How does it work?"

"Just like an ordinary 'peep-hole' disk," Don replied; "only instead of the usual square plate neon lamp, you use a special crater lamp that gives you a brilliant spot of light. Having a point light source, you can project the television images, by means of lenses, on a ground glass screen. I've gotten post card size pictures with that disk, and they were bright enough to be viewed in a room only partially darkened."

As Don spoke, I studied the crater neon lamp more closely. "Funny looking thing, isn't it? The insides look like the cylinder of a motorcycle engine. What are they, cooling fins?" I said, smiling as I pointed to the small ringlike projections on the working end of the gadget supported inside the glass tube (see Fig. 2).

Fig. 2. Three types of crater neon lamps and a simplified sketch showing the construction of the anode and cathode. The cathode fins offer added radiating surface



"That's not as funny as you meant it to be," Don replied. "Those fins do offer a greater radiating surface and tend to keep the temperature of the cathode down. Here, I'll draw a cross section of the tube and try to explain how it works.

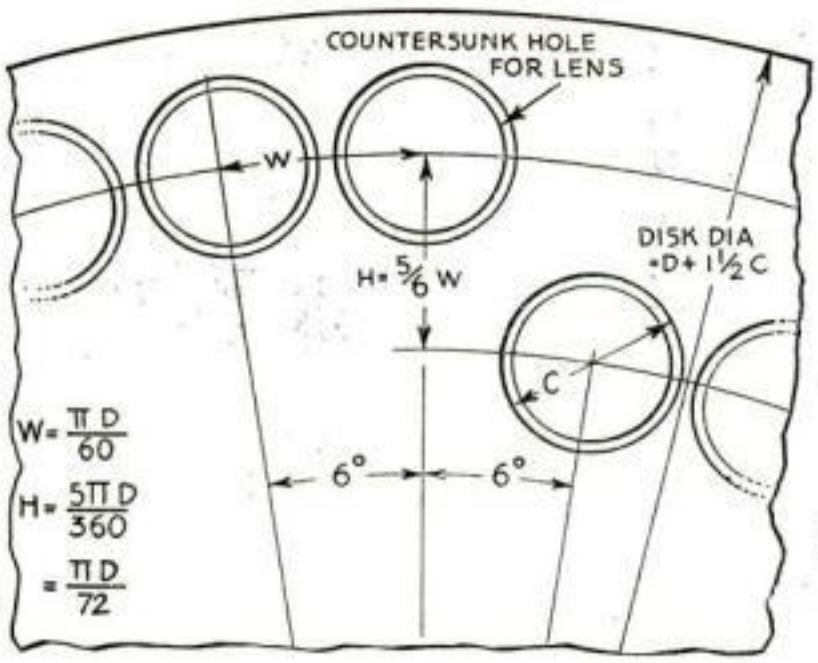
"A crater neon tube," Don pointed out as he made the sketch shown in Fig. 2, "consists of a cylindrical cathode or negative electrode having a small hole in its forward end. The anode, which is a positively charged plate, also has a hole and is so placed that this hole is directly in front of the hole in the cathode. As in the simple neon lamp, the slight emission of electrons starts ionization which causes the cathode to glow. To confine this glow to the front of the cathode, the sides are covered with a ceramic insulator."

"Why is it called a crater neon lamp?" I asked.

"For the simple reason that the cathode glow takes the form of a crater arc at the mouth of the small hole in the cathode. The light from the crater," Don continued, indicating the position with the point of a pencil, "is projected through the small hole in the anode plate, through the lenses, and to the ground glass screen."

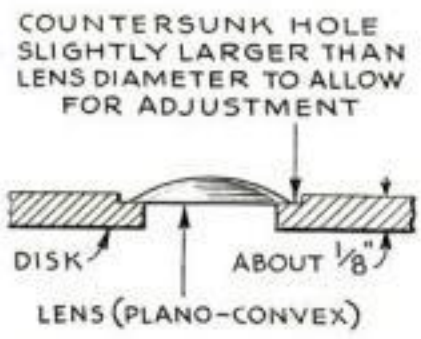
"And the fins," I suggested, remembering what Don had said, "give additional radiating surface to the cathode."

"That's right," Don agreed. "Of course,



HOW TO LAY OUT A LENS DISK

Fig. 3. *At left:* Diagram of layout, where *D* is diameter of circle through the center of the extreme lens. *Below:* How the lenses fit in the countersunk holes



this sketch shows only the fundamentals of the tube. There are other refinements; but as I've explained it, that's the basis on which it operates. And by the way," he added, "the crater lamp is connected into the receiver in just the same way as an ordinary square plate neon lamp."

"It must have been some job laying out that lens disk," I said admiringly. "It was hard enough planning that simple 'peephole' disk of mine. Remember the trouble I had? It was like pulling teeth to get one that was accurate enough to use."

"You won't have that much trouble with a lens disk," Don assured me with an encouraging smile. "You see, each one of those lenses can be shifted to just the right position. It allows more leeway in drilling."

"Yes, but how do you locate the lenses in the first place?" I asked.

"You can start in either of two ways," Don explained. "You can design the disk to a specified diameter and then buy lenses to meet the requirements, or you can pick the lenses up at a bargain sale and design the disk to accommodate them."

"How do the lenses have anything to do with the size of the disk?" I asked.

"Well, naturally you can't have the lenses overlap, so the disk has to be large enough to take sixty lenses placed one beside the other in a spiral. Besides that, you've got to leave some space between the lenses to allow for fastening them in place. In other words," Don continued to explain, "the first lens at the outer end of the spiral will have to be placed on a circle whose diameter is equal to sixty times the diameter of the lenses plus sixty times the distance between adjoining lenses divided by pi (3.1416). Of course, to hold the lenses in place, you'll have to have some metal outside the extreme circle, so you'll have to add the lens diameter plus twice the width of the desired border of metal to obtain the disk diameter." (See Fig. 3.)

"I CAN see that all right. How do you find out where to place the lenses?"

"Since you know the lens diameter and desired distance between lenses, you can figure the distance between the optical centers of adjoining lenses, can't you? Well, that gives you the theoretical width of the image, and five sixths of that gives the theoretical height of the image, which is equal to the pitch of the spiral. You know what the five sixths is, don't you?" Don asked.

"Yes, that's the ratio of the height to the width of the image sent out by the transmitter," I replied. "The five sixths comes from the theoretical dimensions—seventy-two units wide and sixty units high."

"Well then, that gives you the dimensions for the spiral, so all you have to do is scribe in the spiral, draw in sixty radial lines each six degrees apart, and the intersections of the spiral and radial lines give you the locations of the lenses."

"How do you locate the lenses when you want a disk of a specified dimension?" I asked.

"First, you draw in a spiral that will fit on the size disk you want, and locate the sixty centers just as if you were designing a 'peephole' disk," Don said. "Then you figure a convenient size of lens that will allow sufficient space between lenses for fastening them in place. I prefer this method to the other because you can use a 'peephole' disk by using the holes already drilled as the center points for the lenses. That's what I did with this disk."

"What do you do after you've located the centers? Drill holes and set the lenses in?"

"Not exactly," Don said as he made a cross section sketch of the disk through one of the lenses. "First you drill one hole, slightly smaller than the diameter of the lenses; then you countersink it with a drill larger than the lens. The countersink, being oversize, allows for correction in placing each lens." (See Fig. 3.)

"How can you tell where each lens belongs? I should think it would be better to make the hole just the right size, and then when the lens was fastened in place you'd know it was right."

"It can be done that way," Don agreed, "but you have to be sure that the optical and physical centers of your lenses agree. In a lens disk the optical center, not the physical center, must be in just the right position."

"What do you do," I asked, "test each lens in some sort of optical instrument and then place each accordingly?"

Fig. 4. Detail showing the crater neon lamp and the top of the spiral of tiny lenses. The disk rotates clockwise

"NO," DON replied, "it's not as hard as all that. All you have to do is mount the disk on a shaft in a horizontal position and put a bright light source under the disk in the position that will be occupied by the crater neon lamp. Then, by figuring the size of the projected image for those conditions, sketch off on a piece of paper sixty-one lines representing the paths that will be traveled by the sixty spots of light. After that, it's a simple matter, by lining up the screen at the start so that the thirtieth spot just fits between the thirtieth and thirty-first lines, to move each lens to such a position that its spot will cover just the right area between the lines on the chart. The spots should also line up, one below the other, on a vertical line drawn down the center of the chart."

"I see," I said when the idea had penetrated. "First you line up the screen so the lens in the middle of the spiral is right, and then you revolve the disk slowly and shift each of the other lenses so that they are in the right positions."

"That's it, and when the lenses are in the right positions you carefully cement them in place. It pays to check them over and over before fastening them in place for good," Don added.

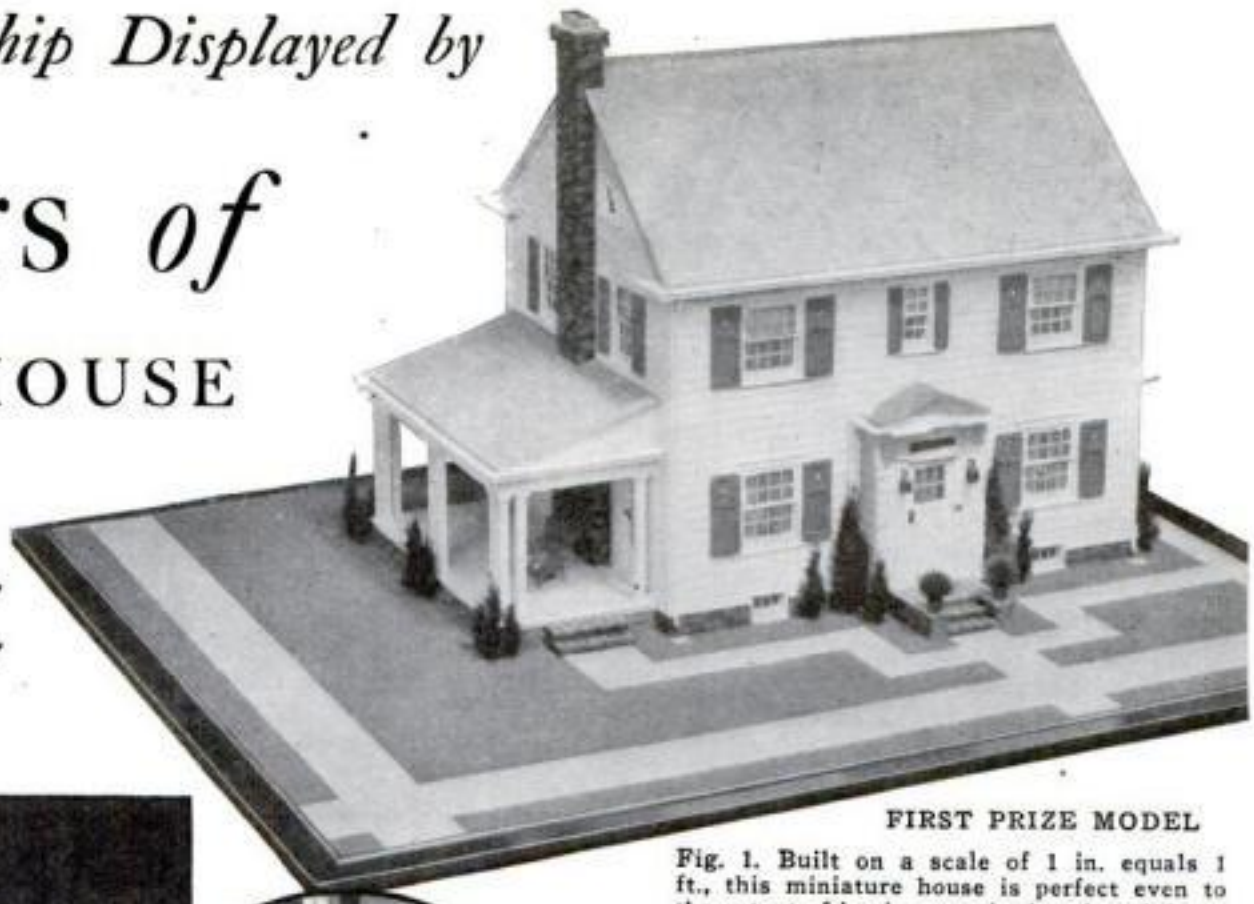
"You haven't said much about the lenses, Don. What kind of a lens do you use?"

"To start out with, of course, they all must have the same focal length. In this disk," Don pointed out, indicating one of the lenses, "I used plano-convex lenses with the plane side toward the crater lamp. It's a matter of opinion, though, which side should be placed outward."

This is the tenth of a series of articles telling of Mr. Waltz's experiences as an amateur television experimenter. The first article appeared in the July, 1931, issue.

Amazing Craftsmanship Displayed by

Winners *of* MINIATURE HOUSE Contest



FIRST PRIZE MODEL

Fig. 1. Built on a scale of 1 in. equals 1 ft., this miniature house is perfect even to the extent of having mortised sash and doors

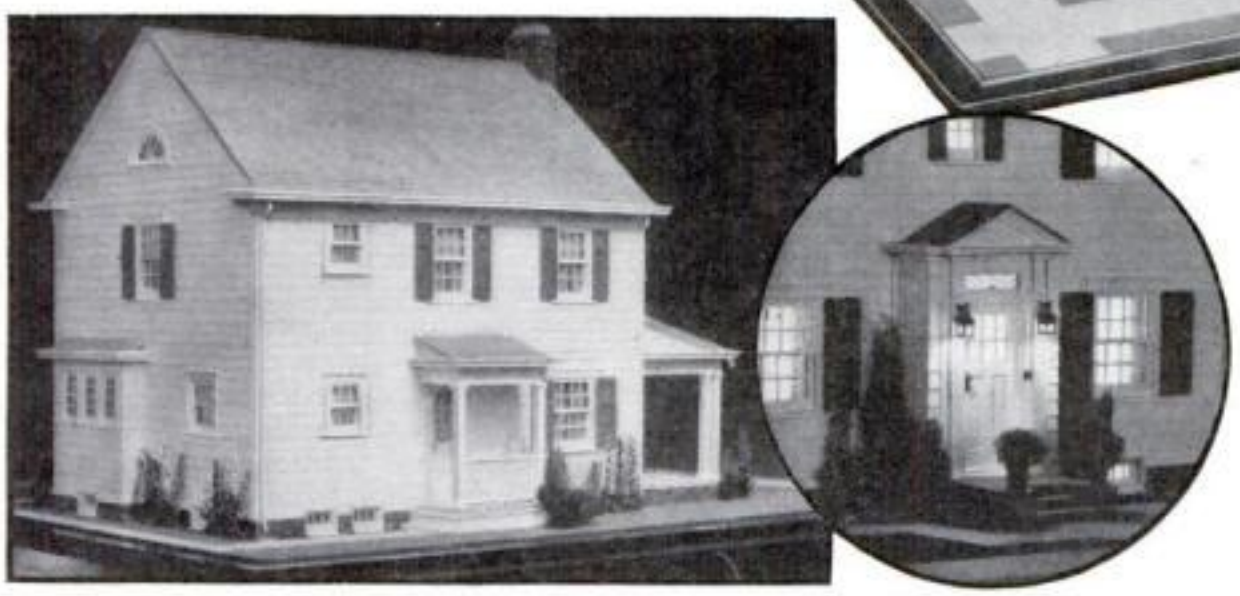


Fig. 2. Rear view of the first prize model and, in circle, the front doorway when the lights are on. The grass is screened sawdust dyed green; the trees are ordinary air fern stiffened with a wire through the center

WON SECOND PRIZE

Fig. 3. This model is to the scale of ¼ in. equals 1 ft., and the landscaped plot is actually 33 by 36 in. Even the tiniest moldings are of the right shape

Fig. 4. Here is the front view of the second prize model. The window glass was cut from old photographic plates. Both top and bottom sash are recessed into the walls as in a real house

THIRD PRIZE HOUSE

Fig. 5. This miniature house was constructed on a scale of ⅜ in. equals 1 ft. Poster board and cardboard were used, with celluloid in the windows to represent glass. The stonework at the entrance is built up in separate pieces

MANY house models of extraordinarily fine design and craftsmanship were entered in our "Build Your Home in Miniature" Contest (P. S. M., Nov. '31, p. 82).

The first prize of $50 was awarded to H. E. Chesebro, of Schenectady, N. Y., for the model shown in Figs. 1 and 2. The sides are of ½ in. thick wood with cardboard strips glued and nailed on to represent siding, and the roof is covered with thin cardboard cut into strips like commercial strip shingles. All the sash and doors are put together with mortise and tenon joints like real ones.

Marion A. Emmons, of What Cheer, Iowa, won second prize of $25 for the model shown in Figs. 3 and 4. The frame is made entirely of pressed wood composition board, veneered with individual strips of white cardboard.

The third prize of $10 went to H. M. Foote, of East Cleveland, Ohio, for the model shown in Fig. 5. The next three prizes of $5 each were awarded to Frederick W. Brown, Windsor, Vt.; J. S. Cotton, Fort Bragg, Calif.; and A. A. Ritter, Racine, Wis. Honorable mention was given the following: James M. Bloomer, Brooklyn, N. Y.; Charles Bruggemann, Yonkers, N. Y.; Charles H. Carroll, Jr., Wheeling, West Va.; N. C. Cushing, Neponset, Mass.; Esther Duckworth, Houston, Texas; Allen Evans, Spivak, Colo.; Richard Fitch, Struthers, Ohio; Willford A. Gagnon, Montreal, Canada; Carleton Goff, Barrington, R. I.; M. N. Kirkwood, Chicago, Ill.; Burton E. Klein, Vincennes, Ind.; Norman O. Nelson, New London, Conn.; D. Rogers Palmer, Forty Fort, Pa.; John T. Potts, Jacksonville, Fla.; Robert J. Schultz, Oak Park, Ill.; George Sharcott, Santa Monica, Calif.; William T. Stiles, Brooklyn, N. Y.; T. D. Taro, Nutley, N. J.; J. Verhoeff, Park Ridge, Ill.

New Ideas of Value to Car Workers

EVEN in these days of broad concrete highways, there still remains a vast mileage of dirt roads where it is easy to get stuck in a mud hole. Fig. 1 shows a simple way to get out of any mud hole, no matter how deep. Take a piece of two-by-four about two feet long and chain it to the front side of the tire in such a position that it will lie squarely across the rut. Start the car slowly and the wheel will ride up over the two-by-four. Then jam on the brake to prevent the wood from being carried up against the mud guard. It may be necessary, if the wheel is badly mired, to repeat the process. If you contemplate a trip during which you are likely to encounter muddy going, be sure to carry a piece of chain and a length of two-by-four in the tool kit.

WIN A $10 PRIZE

Each month we award $10 for the best idea sent in for motorists. This month's prize goes to Wesley Kuhlmann, Woodcliff, N. J. (Fig. 3.) Contributions are requested from auto mechanics, both amateur and professional, and if published will be paid for.

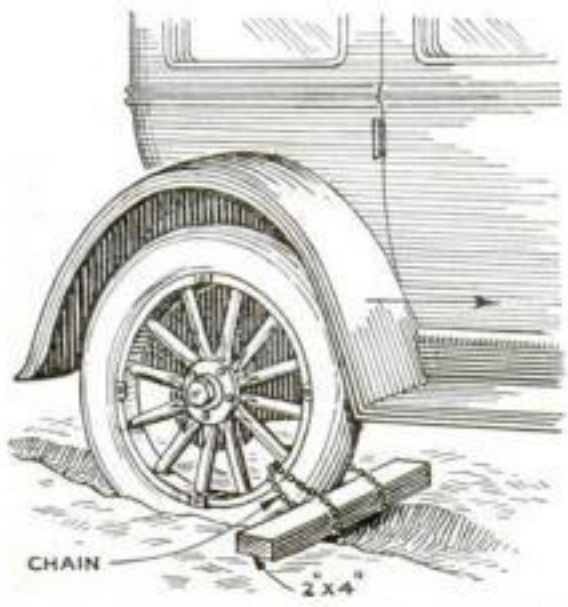


Fig. 1. A piece of two-by-four, chained to wheel, can be used in getting out of mud

Water Supply Tank

FOR week-end picnics, camping trips, and long tours through arid regions, a convenient water supply can be arranged by fitting a special tank to the running board. Procure a suitably shaped gasoline tank from an auto junk yard. Clean thoroughly with washing soda. Plug or patch unused openings and fit the tank with brackets and key type outlet as shown in Fig. 3. The advantage of the latter is that it requires pliers to draw water so children cannot easily open it. Being attached with only two bolts, it can be removed in a minute or two when not wanted.

Repairing Muffler

A SIMPLE, quick and lasting repair can be made to a muffler that has been blown out by a back-fire. Cut a strip of sheet asbestos several inches wider than the hole and long enough to go twice around. Cut a strip of galvanized sheet iron as wide as the asbestos and one and one half inches longer than the circumference of the muffler. Make a right angle bend at each end to form a bolt flange. Wrap the asbestos tightly around the muffler, center the hole, and bolt it in place with the galvanized iron band. This method of repair is of no value on a muffler that has rusted through.

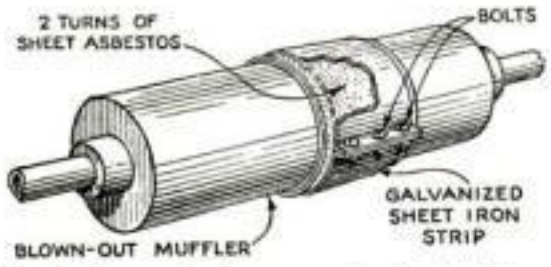


Fig. 2. Sheets of asbestos and galvanized iron give a lasting patch for blown-out muffler

Test for Leaks

THE simplest way to test a tube for leaks is to place it under water and watch for bubbles. However, the usual round tin tub or wooden wash tub takes up a lot of room. An excellent water container for this purpose is a section of a large truck tire attached to the wall as shown in Fig. 4. It takes up little space and its shape matches that of the partly inflated tube. Wooden struts should be used to spread the beads to the proper width. A suitable section of a blown-out truck tire can be obtained at little expense from the nearest auto junk yard.

Fig. 4. Section cut from a large truck tire can be used as water container in which to test inner tubes for leaks

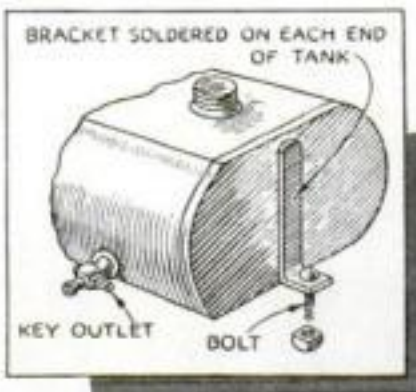


Fig. 3. Old gasoline tank fastened to running board makes an excellent container for water when on a picnic

To Hold Up Hood

WITH many types of cars, it is impossible to raise both sides of the hood at once whenever there is any repair work to be done. However, it is possible to get the desired result by the use of a forked board as shown in Fig. 5. An ordinary clothespin could be used, of course, but the weight of the hood might split it, allowing the sides to crash down. Note that the forked board should be reinforced with a cross bolt to eliminate this danger. If the car has an extra long hood it is desirable to make two forks so that one can be used to hold the hood sections together at each end. Do not attempt to make these forks out of light soft wood as they will not be strong enough for the purpose, but use well seasoned hardwood.

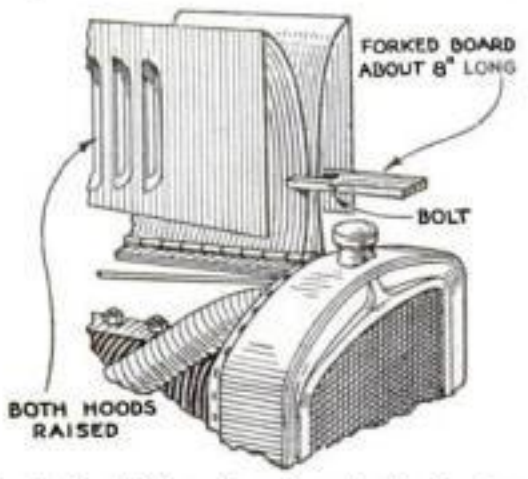
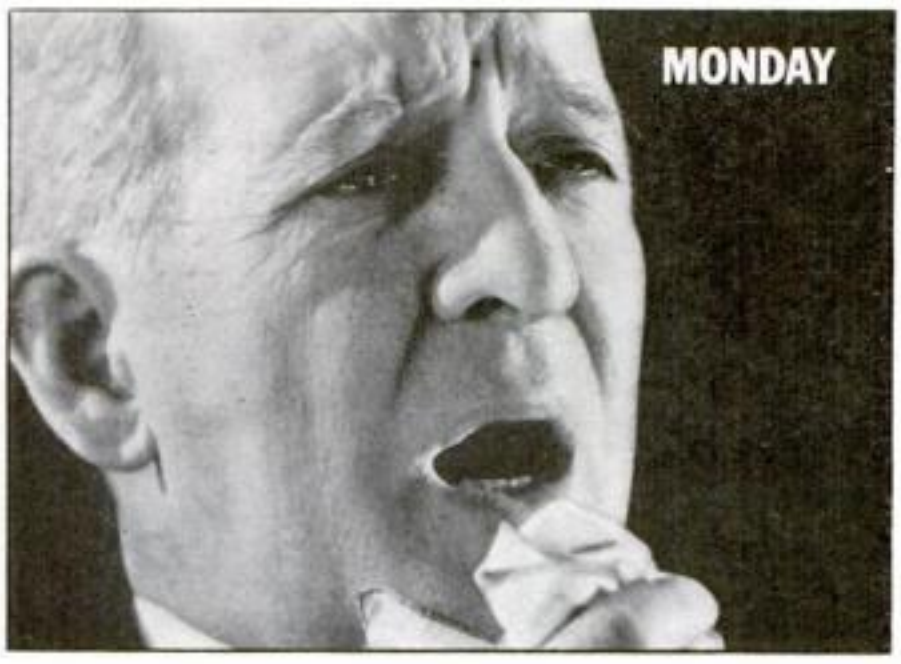
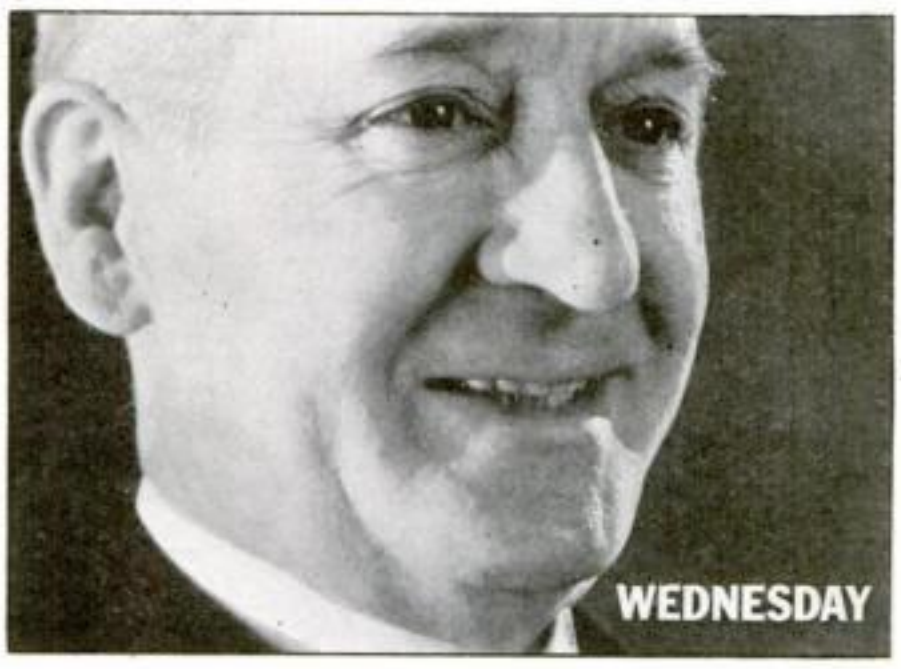


Fig. 5. Forked board, used as in the drawing, makes it possible to raise both sides of hood

GETS RID OF COLDS IN 3 DAYS INSTEAD OF 9!





Listerine gargle cuts duration of colds 66% severity 75% tests show

Once again the power of full strength Listerine to ward off infection, by means of its swift, safe, germicidal action, is revealed by a series of unusual tests.

Bear the results of these tests in mind. They point to better health, greater vitality, and freedom from pain and discomfort.

Between November 15, 1930 and February 1, 1931, 102 persons in normal health were kept under medical observation. Thirty-four of them, designated as "controls", did not gargle Listerine. Thirty-four gargled with full strength Listerine twice a day. The remaining thirty-four gargled five times daily. Now see what happened:

One-half as many colds for garglers

The "controls" (those who did not use Listerine) contracted twice as many colds as those who gargled Listerine twice daily. Moreover, their colds lasted three times as long and were four times as severe.

Now let us compare the "controls" with those who gargled Listerine five times a day:

The "controls" had three times as many colds, which were four times as severe and lasted four times as long.

Results every time

Similar tests conducted over periods ranging from four weeks to four and one-half months show equally convincing results.

In a four-week test, Listerine users contracted one-ninth as many colds as non-Listerine users.

And the colds lasted one-eleventh as long as colds contracted by non-Listerine users. In a four and one-half month test, Listerine users had only one-third as many colds which were one-fifth as severe as the infections developing in non-Listerine users.

Kills germs, yet safe

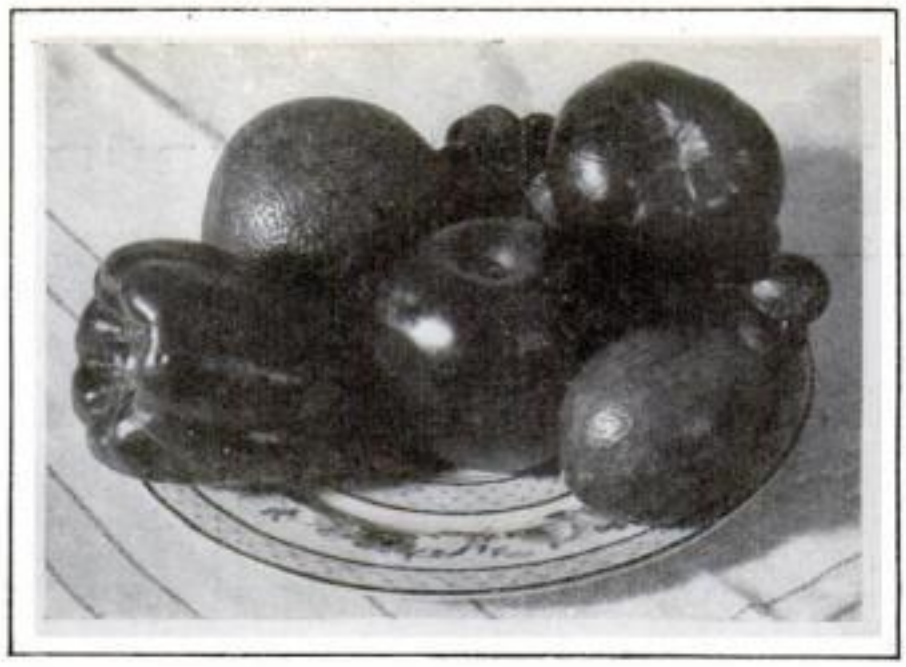
What is the secret of Listerine's success used this way? The answer is its ability to kill germs in the fastest time without harm to the delicate tissues of the mouth. Used as a gargle, full strength Listerine reduces bacteria on the surfaces of the mouth, 98%. At the end of two hours, a reduction of between 75% and 80% is still evident. Ask for Listerine and see that you get it. Its results are certain and its action is safe.

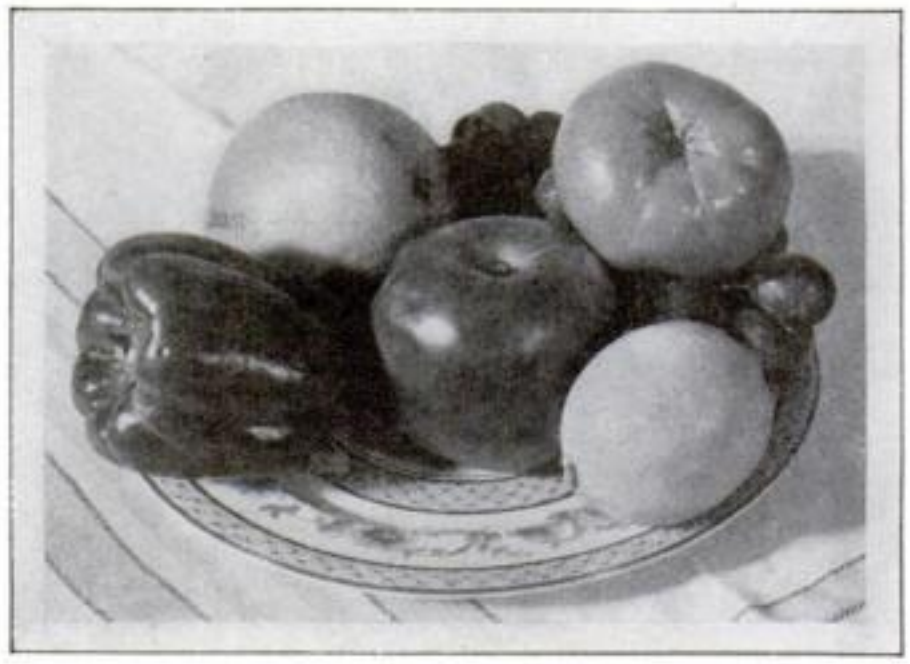
Lambert Pharmacal Company, St. Louis, Mo., U. S. A.

kills germs YET *safe* TO USE

Making Colors Behave *in your* PHOTOGRAPHS

By FREDERICK D. RYDER, JR.





These photographs show in a striking way how important it is to use color-sensitive films. The upper illustration was taken with what is really "color-blind" film. The lower photograph shows the same subject as photographed with a supersensitive panchromatic film. It represents the color values quite accurately

"WHAT I want to know is, what is color value in a photographic film and how does it affect the pictures I take? How can a film that takes pictures in black and white have any color value if it doesn't register colors at all? This talk about 'panchromatic,' 'orthochromatic,' and all the other fancy names has me in a fog."

The writer of the letter from which these questions are quoted may be in a fog as he says, but if so, he certainly has plenty of company. Although most amateur photographers—even beginners—know that there is such a thing as color photography, they don't understand the effect the color of an object has on the way it will appear in their own pictures.

A friend, for example, recently showed me a picture he had snapped of his little sister. The young lady, he said, had on a bright orange dress which made a very pretty contrast with the deep green foliage of the background. The print, however, showed her in a dress so dark that it merged with the mottled black of the background. The snap was quite obviously a trifle underexposed, but the lack of color sensitiveness of the plain film he was using was mainly responsible for the poor result.

Another man, an enthusiastic amateur gardener who has recently added photography to his list of hobbies, complains that the pictures he takes of the things he grows never seem to look natural.

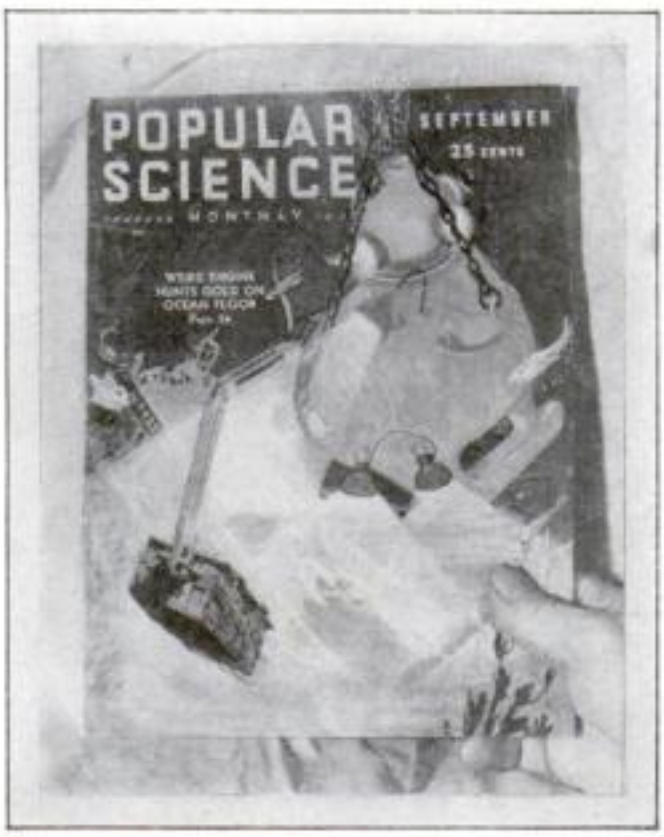
A third man I know never worries about color values. The pictures he takes always seem just right to him—but he is completely color-blind, so he actually sees things just the way "color-blind" plates or films register them.

The point of the whole matter is that light is made up of a whole series of different vibrations, each one of which registers in our eyes as a different color ranging all the way from the violet to the deepest red.

Ordinary color-blind photographic plates or films are vastly more sensitive to the violet and blue end of the color spectrum than they are to the other colors. Red light, even relatively strong red light, affects such plates or films only to a trifling degree. Pure yellow and pure green also have little effect, but a light that may look green to the eye because it is composed of the proper amounts of yellow and blue would affect such photosensitive material because of the blue vibrations in the combination.

In the early days of photography, the only plates or films that anyone knew how to make were of the color-blind variety. In fact, when motion picture photography first came into general use, the actors had to make up in a weird and wonderful way to counteract the insensitiveness of the early "color-blind" motion picture film. They used blue lip rouge instead of red to prevent their lips from appearing entirely too black, and a stage actor with light blue eyes hadn't much chance of success in the films because his eyes registered white and had a washed-out and uninteresting appearance. On the other hand, many a red-haired girl passed for a raven-haired beauty because color-blind film saw red hair as black—provided, of course, that

(Continued on page 111)



Two black-and-white reproductions of a strongly colored magazine cover. The one at the left was taken with film that does not register color values, and that at the right with panchromatic film

Make your own Movies at the airport

Ciné-Kodak "M" loads with full 100 feet of 16 mm. film. Its lens is the Kodak Anastigmat f.3.5. Price, with leather case, and close-up attachment, $75. Easy terms obtainable.

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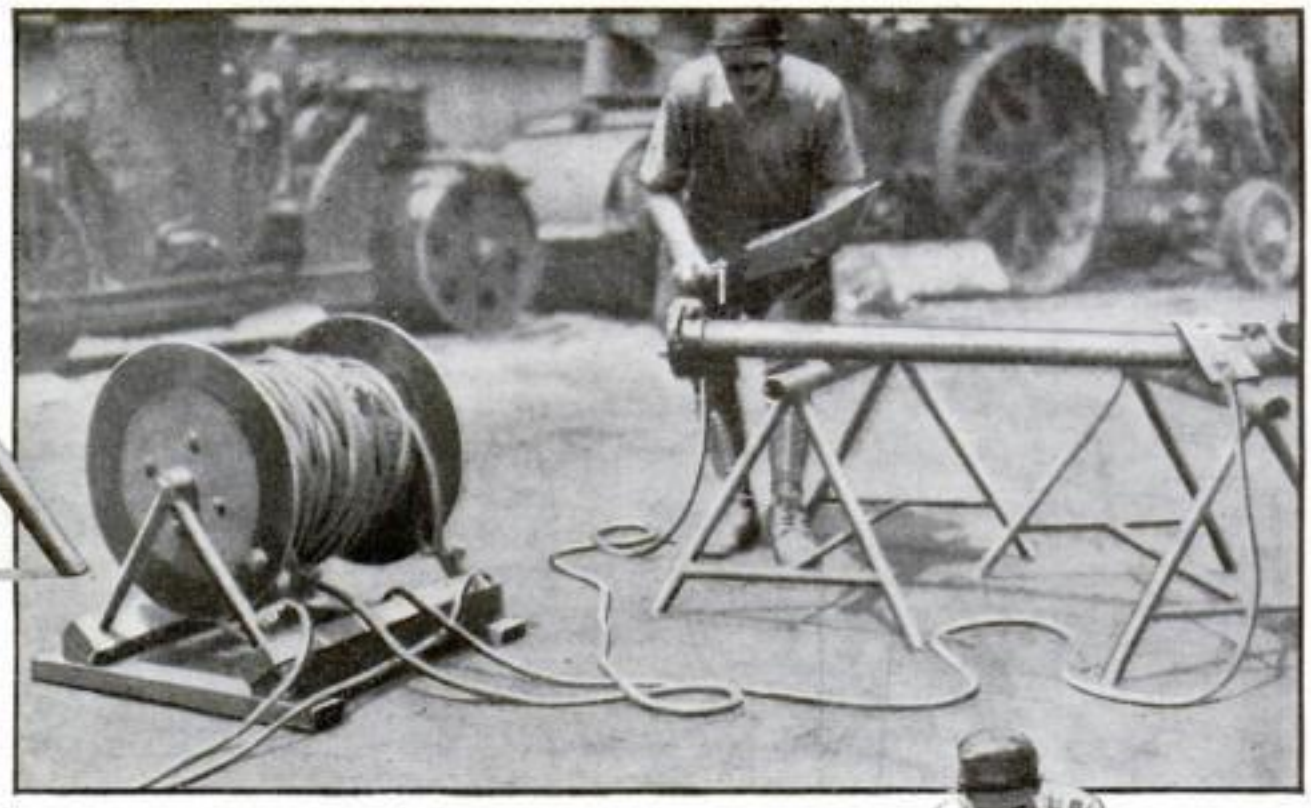
Giant Spool Keeps Arc Welding Cable in Order

This heavy-duty horse for general shop use is made by welding ordinary pipe



ONE problem every arc welding operator has to meet is keeping his cable easily accessible and in good order. In two of the accompanying illustrations is shown a convenient spool that will hold 250 ft. or more of double cable and can be wound or unwound as required.

The spool is a wooden drum 10 in. in diameter and 20 in. long, made either of solid stock or by nailing 1½ by 2 in. stock to three disks 2 in. thick. Bolted to the circular ends of this drum are two plates of 3/16-in. steel 22 in. in diameter. Each plate has a piece of 1½-in. steel shafting 4 in. long welded to its center. The plate should be drilled to take the shaft, and then undercut on the inside so that the weld will be very strong. On each circular plate near the circumference, a hole is drilled to take a ½-in. bolt for the cable connection. When these connections are made, the nut should be welded to the bolt to prevent its becoming loose and thus weakening the contact.

The frame consists of two ends, each being made of two pieces of 1½-in. pipe 15 in. long. They are 20 in. apart at the bottom, and are sloped to meet a 2 in. diameter steel bearing, to which they are welded. The bearing is simply a ring of steel 2 in. wide, but it must be copper bushed to take the spool shaft projection, otherwise the current will arc and fuse the steel. The ends of the frame are set into pieces of "two by four," drilled to receive them. To provide for the necessary slope, each piece rests upon a "four by four," cut diagonally to make supporting wedges.

A hole is drilled near the bottom of each front support for a ½-in. bolt, which takes the connections from the welder. The bolt may be welded in place, but the nut is left free, as it may be desired to remove the connections to shift the equipment. The right-hand bolt (facing the spool) should be marked "plus" for the ground cable, and the left, "minus" for the electrode-holder cable. These markings may be reversed, but it is important that the poles be marked so that the proper connections may be made and remade when necessary. There is no danger of receiving a shock, when the welder is in operation, by grasping the two sides of the spool. While this forms a circuit, the voltage is too low to be felt.

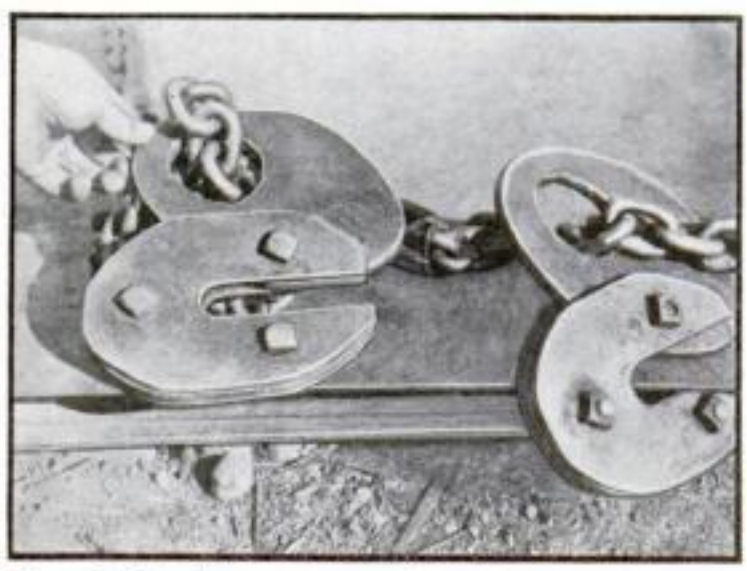
A strong and sturdy type of nontipping horse is also illustrated. It may be made easily and quickly from ordinary pipe, welded together. The pipe required for one horse is as follows: Top, 1 pc. 2-in. pipe 36 in. long; legs, 4 pc. 1-in. pipe 24 in. long; short ties, 2 pc. ½-in. pipe 17 in. long; long tie, 1 pc. ½-in. pipe 33 in. long. While these sizes were used in the horses illustrated, any available sizes may be utilized.

The construction is very simple. The legs are spaced 20 in. apart at the bottom, and the short tie is welded in place 7 in. from the bottom of each leg. Then the tops of the legs are welded to the 2-in. pipe, each leg being sloped so that the weld is made 4 in. from the end of the 2-in. pipe. This not only gives greater strength to the horse, but prevents the leg from tipping when in use. While the last distance may be varied, the end of the 2-in. pipe and the bottom of the legs should be in line. The long tie is then welded in place, which completes the horse.—H. CALDWELL.

In this photograph and the larger one above is shown a spool for holding a welding cable

ODD HOOKS FOR HANDLING SHEET METAL

A SIMPLE and safe hook for handling heavy metal sheets, with no sharp corners to tear the hands or damage metal surfaces, may be made as shown from three 6 by 8 in. oval sections of ½-in. steel plate. The lower halves of two of the oval sections are bolted on each side of a filler of ¾-in. plate. Along the edge of this filler, a 1½-in. gap is cut in the two sheets, extending to a point a little past the center of the oval. This gap is for the reception of the sheet. The sheet is gripped by one end of the third oval section, which is hinged into the other two by a bolt placed about midway along the gap, as illustrated. The hoist chain is hooked in or passed through a hole at the back end of this third section.—J. C. COYLE.



These hooks give a strong grip on heavy metal sheets, yet have no sharp corners or points to cause damage

ONE secret of success in grinding work expertly is to "spark out" the cut.

After a bout with the hacksaw

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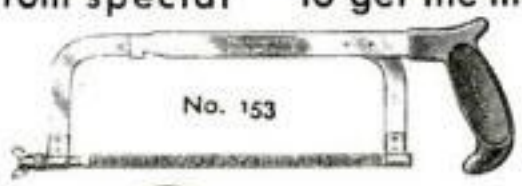

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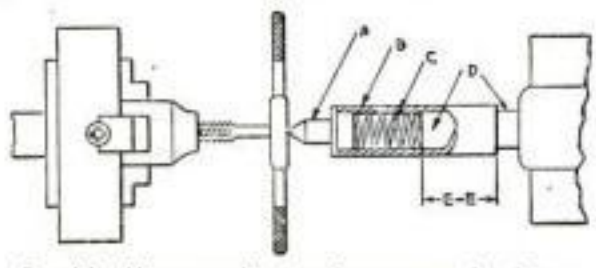
SPRING CENTER FOR TAPPING IN LATHE

Using a hand tap in the lathe with the aid of a special center that follows up the tap

EVERY machinist knows how difficult it is to keep the lathe center constantly against the tap when tapping by hand in the lathe. The accompanying drawing shows a substitute center *A* pressed into the end of a piece of tubing or pipe *B*, which is bored to a slide fit on the tailstock quill *D*. The spring *C* is the active member. When the tailstock is locked on the ways and *D* is advanced to compress the spring, *A* is held firmly against the end of the tap and will follow up constantly as the tap feeds into work; it will also back up as the tap is turned back to free chips, allowing the workman to use both hands on the tap wrench throughout the operation. As indicated at *E-E*, the pipe or tubing should slide over *D* enough to hold its central position.

Part *A* in the original fixture was made from a short end of steel. A piece of galvanized iron pipe with a hole a trifle smaller than the quill size and about 7 in. long was first chucked in the lathe and cleaned up on the outside back for 6 in., so that I could use an indicator on it later. I then cut it off about 5½ in. long. Next I chucked the piece of steel for *A* and turned the center and the outside diameters, leaving the end that was to be pressed into the pipe .002 to .003 in. larger than the quill. This piece was then chucked the other end around and the surplus stock faced off.

I finished the pipe by chucking it and truing it up with the indicator, then boring through the entire length to a size from .001 to .0015 in. larger than the quill. Leaving this in the chuck, I pressed the steel center into it by using the tailstock for a press. Before removing the work from the chuck, I took another light cut over the point of the center to true it up. An automobile valve spring completed the fixture.—J. S. REA.



In this diagram the tapping center is shown partly broken away so the spring may be seen

Old Bill *Says..*

REAMERS, plug gages, or similar tools that must be finished under 3/16 in. in diameter always should be made with male centers.

When making an angular cutter, mark it with the angle it will cut, never with that of its own form.

If a light bulb burns out, a good man will never replace it with one taken from a vacant machine. He will get a new one from the stock room. That is because he knows it will save time in the end.

To get a few pointers from a good tinsmith occasionally is a great help to any toolmaker.

You can easily grind down an end mill and make it serve as a reamer in an emergency. This idea saves time, and nothing is wasted.

There are many jobs that can be surfaced or squared on a plain or a rotary surface grinder in half the time required with a shaping operation.

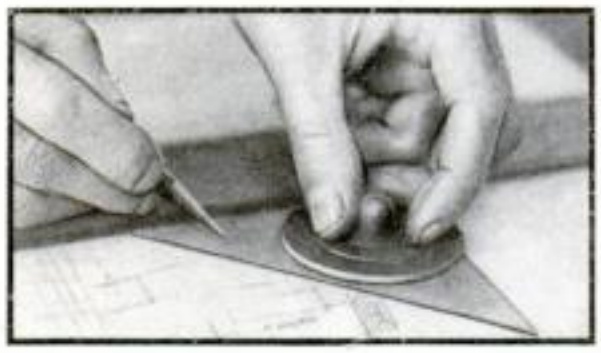
Take care not to drop a chuck or any heavy piece of work on the table of a machine, especially a grinder; even a moderate blow will spring up the ends.

For safety, always adjust the guard on a grinder to meet the requirements of the wheel diameter.

If your skin is irritated from the oil or compound of a milling or screw machine, use Castile soap freely when washing.

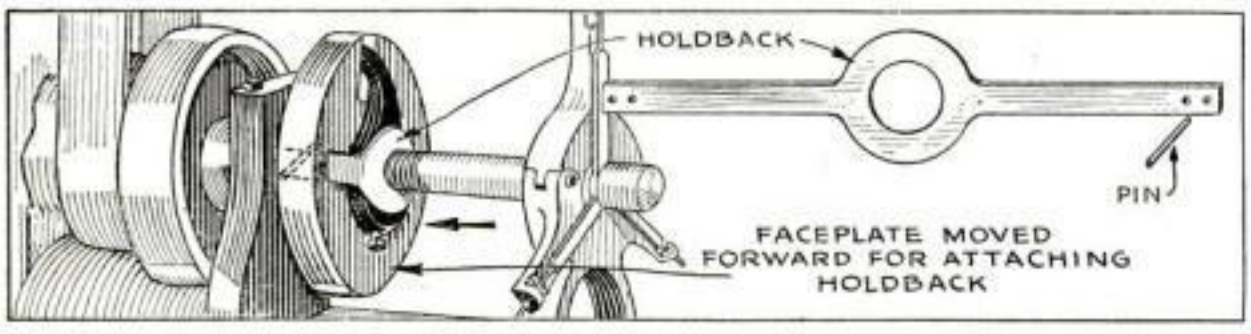
RUBBER GRIP IMPROVES SMALL TRIANGLES

ANY small celluloid drafting triangle is easier to use for fine cross-section work or intricate mechanical drawings if a handle is fitted to it as illustrated in the photograph at the right. This finger grip is nothing more than a common soft rubber suction sink stopper, trimmed down until it does not extend beyond the edges of the triangle. It is merely laid on the celluloid, and the fingers are then rested lightly and naturally on it as shown. The soft rubber gives such a good grip that the triangle can be moved with surprising steadiness and exactness for long periods of time without cramping the fingers. A sink stopper of the type described can be obtained in almost any of the larger ten-cent stores, and also in hardware and house furnishing stores.—F. W.



HOLDING BACK WORK IN LATHE STEADY REST

CUT from old belting, the holdback shown below is better for work being turned in the steady rest than the belt lace ordinarily used. To apply it, run the drive plate forward, place the holdback on the work, insert the pins, and run the plate back, which will tighten the strap and hold the work.—ALLAN B. SHAW.



"SOAPER" HOLDS SMALL PARTS FOR CLEANING

SCREWS, bolts, and other small parts often have to be soaked or washed in kerosene or gasoline to remove grease and dirt. This can be done more easily if they are placed in an inexpensive water soaping device such as may be bought in most stores which sell house furnishings and kitchen supplies. Drop the parts into the "soaper," snap the halves together, and work it vigorously back and forth in a pail or can of the cleansing fluid. While still in the small cage, the parts can be further cleaned with a steam or air jet, if this is considered desirable.—B. W.

This makes a useful little basket for washing bolts

ADJUSTABLE PAPER BAND "POTS" FOR GARDENERS

GARDENERS, florists, and flower lovers use paper band "pots" by the thousands for sprouting seeds and for conveniently transferring plants from cold frames to the field. The bands not only make the small plants easy to handle, but protect young cabbages, beans, and other tender plants from the ravages of rabbits and cutworms. These bands

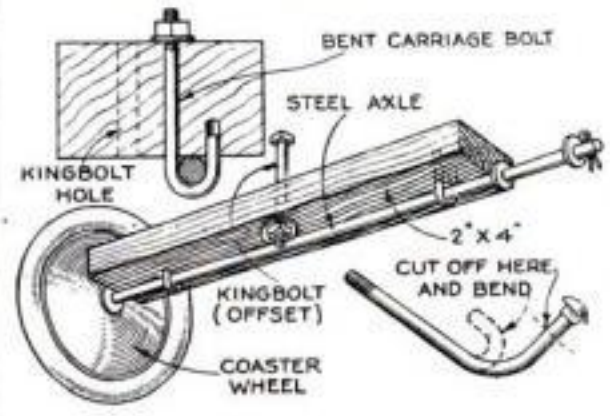
Seedling "pots" made of paper

usually cost about $2.50 a thousand, but I make my own for very much less, and my bands have the great advantage of being adjustable in size.

I use a piece of heavy paper about 4 by 12 in. and fold it lengthwise. The doubled strip is then wrapped around a condensed milk can, which serves as a form, and fastened as close to the end as possible with a large wire paper clip. The clips can be used over again. If a supply of old No. 10 size envelopes are available, they make good bands when doubled lengthwise. The paper "pots" are filled with rich dirt, which is pressed in tight with thumb and forefinger and thoroughly wetted.—G. E. KELSO.

HOW TO BOLT THE AXLE ON A COASTER WAGON

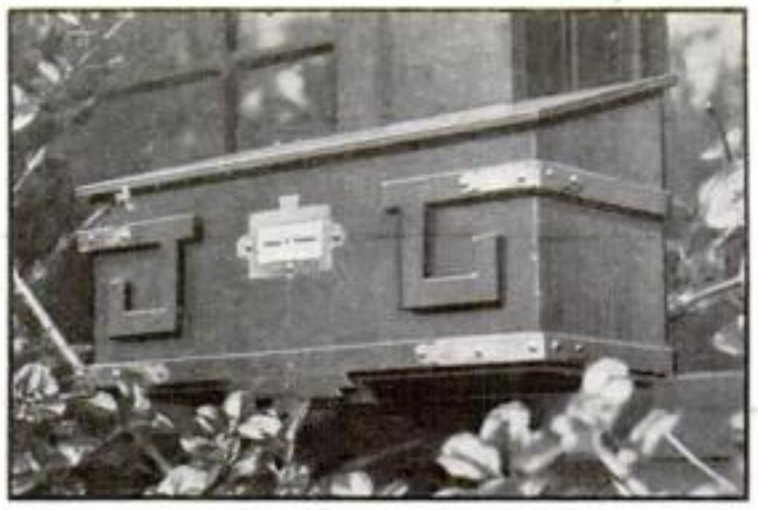
IN MAKING coaster wagons, boys are confronted with the problem of fastening the steel axles to the wood securely enough to withstand rough usage. The usual method is to drive in spikes and bend them over the steel axle, but in a



Two carriage bolts with the heads cut off are used to fasten the steel axle securely

collision these either loosen or split the wood. A better method is to cut the heads off ¼-in. carriage bolts, bend the ends to a U, and set the bolts in holes bored in a "two-by-four."—H. S.

Novel Mail Box



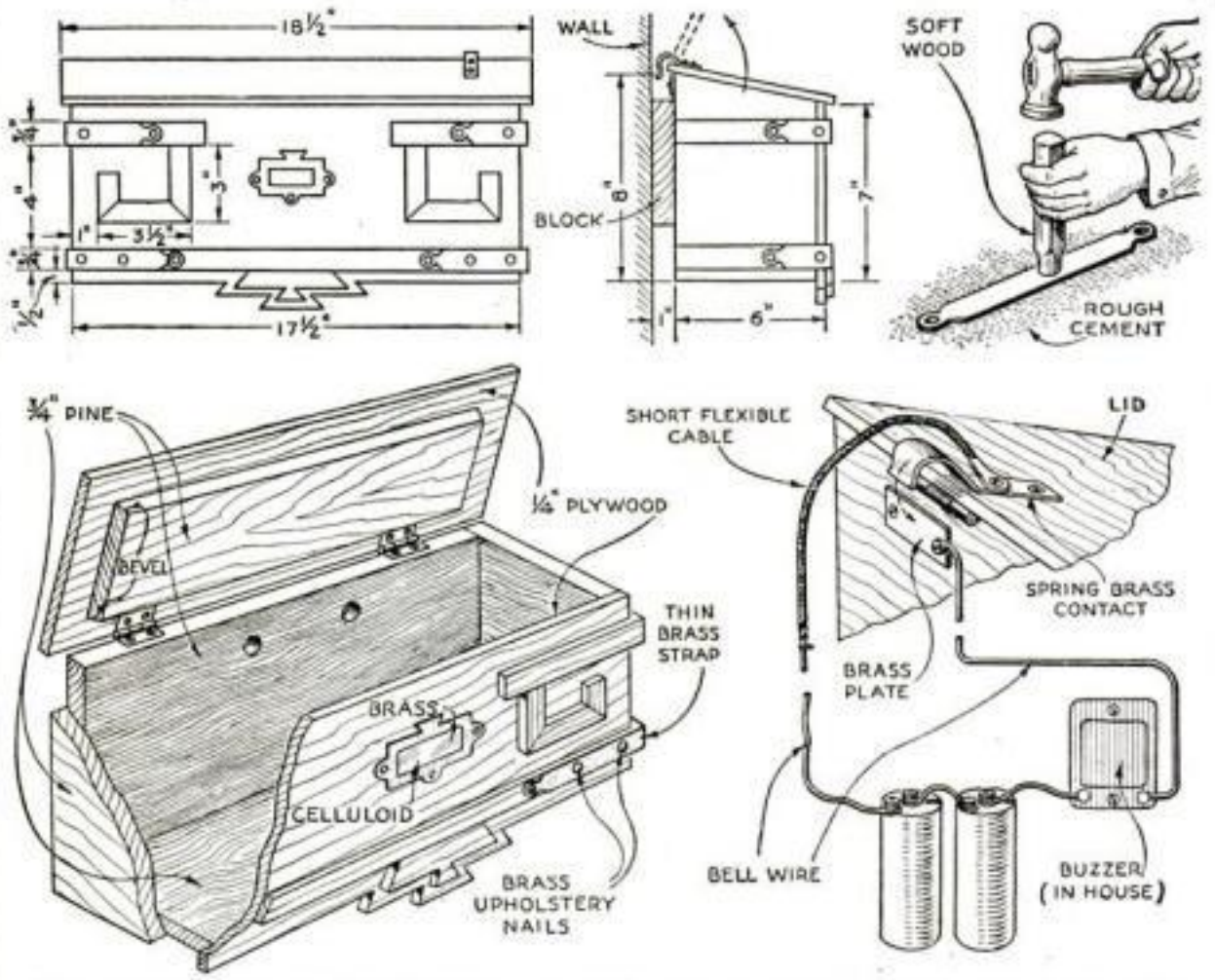
Rings Buzzer when Letter Carrier *Comes*

GOING out to the mail box every few minutes to see if a belated letter carrier has arrived is never necessary with a mail box like that illustrated. It announces the postman's arrival by ringing a buzzer inside the house. Incidentally, it is a receptacle large enough to hold papers and magazines. If you have watched a postman try to stuff bulky envelopes through the tiny slot of an ordinary mail box and drape other mail all over the outside on a stormy day, you will understand what an advantage it is to have a commodious box.

This attractive mail box is large enough to hold papers and magazines as well as letters

This construction is of the simplest. Plywood ¼ in. thick of the so-called waterproof type (that is, glued with casein glue) is used for the front and lid, and ¾-in. pine for the remainder. Fasten the box together with finishing nails, well driven in; fill the holes with composition wood; and apply a coat of walnut oil stain before putting on the molding. The molding is ¼ by ¾ in. material, mitered where shown in the perspective drawing. It is well to paint this green before nailing it in place.

For the corner straps and card frame, use thin sheet brass and give it a pebbled appearance by placing it flat on a rough cement driveway and embossing it with a piece of soft wood and a hammer. The



Front and end views of the box with suggested dimensions; a perspective drawing to show the method of assembly; the way the brass is "embossed;" and a diagrammatic sketch of the wiring

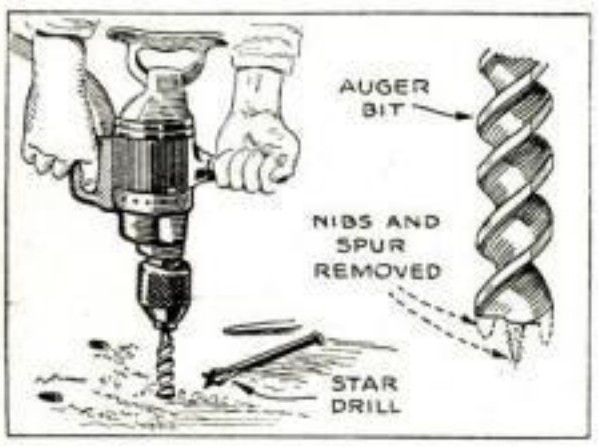
pebbly surface is more effective than the plain brass.

On the underside of the lid nail or screw a ¾ in. thick piece of pine with beveled edges to resist the tendency of the thin plywood to warp. The hinges should be riveted or bolted to the plywood lid, as screws will not hold well. A 1-in. block is screwed to the back to set the box out from the wall and allow the lid to open.

For the announcer system, screw a brass plate to the back of the box near the top as shown, and on the lid fasten a strip of spring brass bent so that it will make contact with the brass plate when the lid is opened. Use light flexible cable to connect one side of the buzzer circuit with the bent contact on the lid, and rubber covered wire to connect the other side of the circuit with the brass plate. Inside the house ordinary bell wire can be used, the batteries and buzzer, being connected as shown in the wiring diagram. The writer ran the wiring under the house and up through the floor to the buzzer.

The box was given two coats of dark green paint on the lid to match the molding and one coat of Chinese red on the inside. It was then finished over both stain and paint with two coats of spar varnish. Since the lid cannot remain open by the nature of its construction, the contents of the box are always fully protected from rain or snow.—Hi Sibley, Jr.

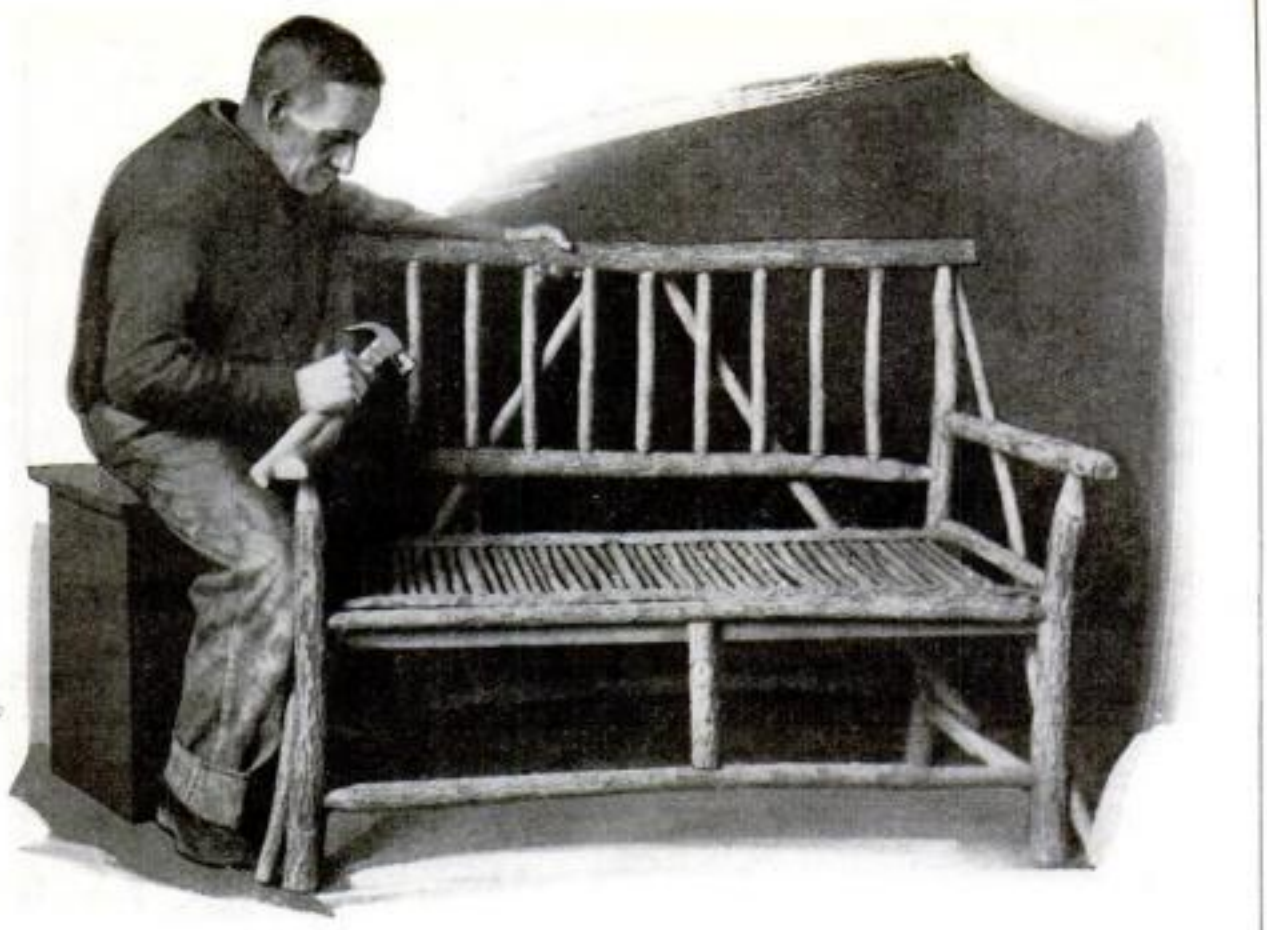
GROUND-OFF AUGER BITS DRILL HARD CONCRETE



The holes are started with a star drill and finished with an auger bit modified as shown

ABOUT 3,000 holes ¾ in. in diameter and 2 in. deep had to be drilled in an especially hard concrete floor of a school auditorium for fastening the seats. I tried various kinds of twist drills in an electric drill, but they failed to do the work. After one or two holes had been made, the drills were worn to a taper, and tapered holes would not hold the expansion shields properly. Finally an old carpenter suggested that I use a double-twist auger bit with the nibs, screw point, and square shank cut off. I followed his advice and found that I could bore about 50 holes an hour and that one auger bit would drill about 200 holes. I had to mark the position of each hole with a star drill to make a slight depression in which to start the auger bit.

The reason this expedient worked so well was undoubtedly because most of the wear came on the end instead of partly on the side, and as the bit wore down a new cutting edge was constantly being formed.—K. L. J.



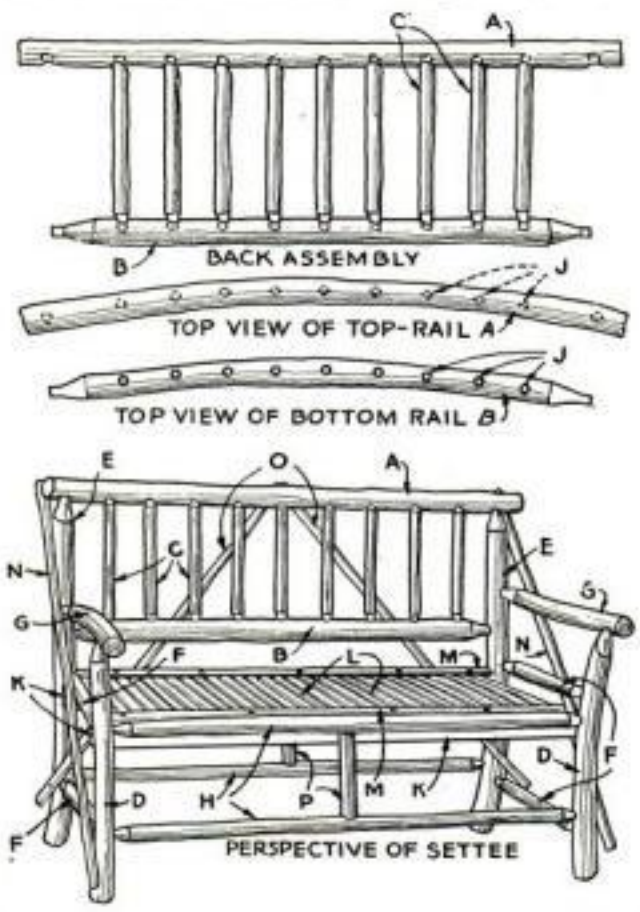
EASY WAY TO BUILD

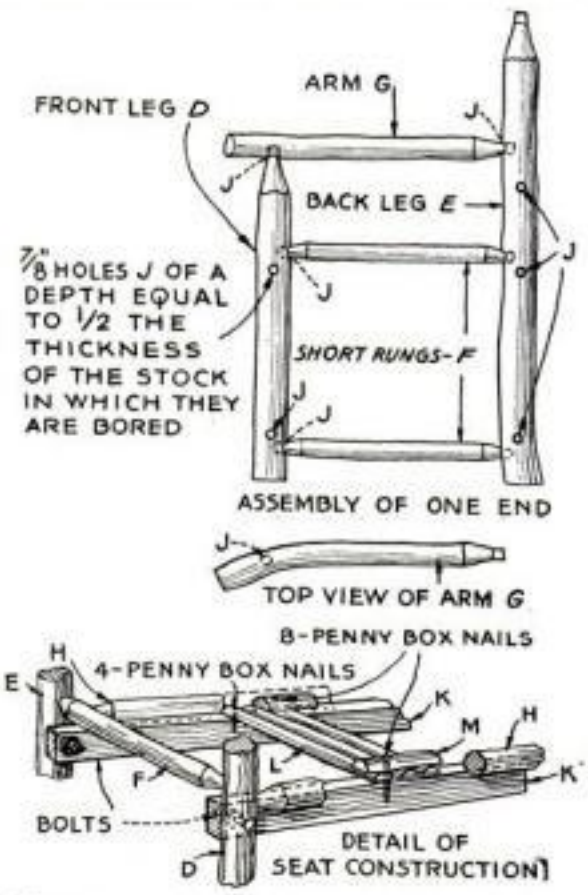
A Picturesque RUSTIC SETTEE

BY A. C. SHUMAKER

RUSTIC settees of a type that will enhance any garden may be made at a cost of about 50 cents each by anyone who is willing to cut his own wood. I use willow, hickory, or sassafras found along streams, old fence rows, or in cut-over land. The hickory should be cut in the late fall or winter, otherwise it is likely to become wormy; but the other two can be cut at any time, and either worked up at once or allowed to dry. Only one kind of timber, and that all dry or all green, should be used.

The tools needed are a saw, an ax or heavy hatchet, a brace, one ⅞-in. auger bit, one ¼-in. bit, a claw hammer, and a yardstick. For a settee like that illustrated the following hardware is required:





How to assemble the back and end units; the seat construction; and the completed settee

1 lb. each of 4-, 6-, 8-, and 10-penny box nails; 1 lb. 16-penny spikes; 4 bolts, 3 by ¼ in.

To make the back, cut 1 top-rail *A* 1¾ to 2 in. in diameter (inside the bark) and 43 in. long; 1 bottom rail *B* the same diameter and 39 in. long; and 9 spindles *C* 1 to 1¼ in. in diameter and 13 in. long. For each end assembly, cut 1 back leg *E* 2½ to 3 in. in diameter and 34 in. long; 1 front leg *D* the same diameter and 24 in. long; 2 rungs *F* 1½ in. or more in diameter and 17 in. long; and 1 arm *G* 2 in. or more in diameter and 22 in. long. The following are also needed; 6 fairly straight lengths 1½ to 1¾ in. in diameter and 48 in. long for long rungs *H* and to cover ends of seat bottom as at *M*; 6 pc. about broom-handle size for braces *N*, *O*, etc; a number of straight lengths *L* ¾ to 1 in. in diameter for the seat bottom; and 2 pc. dressed lumber *K* 1 by 2½ by 48 in. for the seat supports.

THE best way to get what you want is to take saw, ax, and yardstick to the country. Notice how the arms and legs crook. The back legs and back rails crook to the back, the front legs to the side, and the arms also have a curve to the side. Knots and limbs do no harm; you can dress them down smooth.

Taper the ends of the rungs and top of the legs with an ax by placing the end on a solid block of wood. Don't cut them too small—just enough to start in a ⅞-in. hole. Make the back assembly as shown and lay it on the floor to see that all four ends of the rails touch.

Bore all holes (marked *J*) ⅞ in. in diameter and as deep as half the diameter of the wood. Drive the parts together, using a block of wood to protect the bark. Set the nail heads under the bark.

When the back and two end units are together, set the ends up, hang the back in place, and drive the back top-rail down to its position. This will give you the correct place to bore the holes for the bottom rail of the back. Lay the ends down and mark for the other long rungs—3 in. from the bottom of the legs for the bottom rungs and 15 in. up from the bottom for the rungs at the front and back of the seat. Put the back on the ends again and drive the parts solidly together, but don't nail. Spread the front so that it is about as long as the top of the back. You can then measure for your long rungs.

BE SURE the front and back legs touch the floor evenly and that the front looks to be in proper relation to the back. Drive all together and nail each rung.

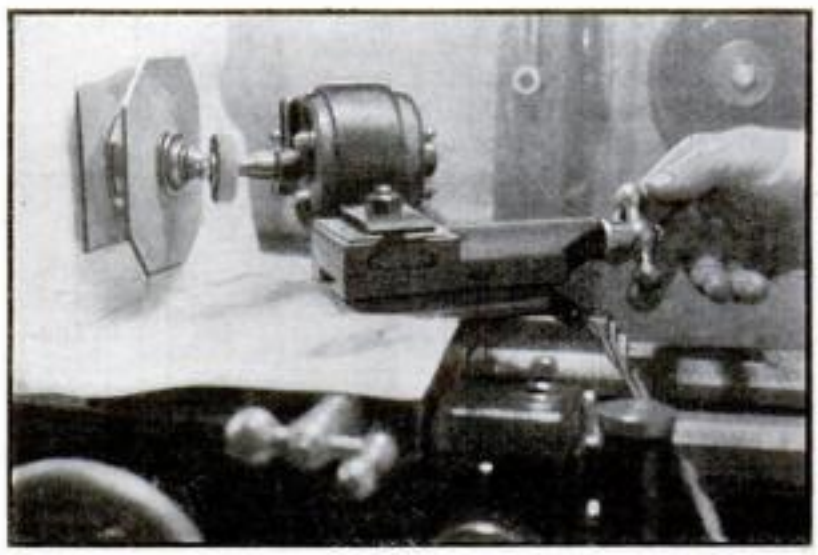
Put on the braces as shown, then bolt on the dressed lumber for the seat supports, the top of which should be 15½ in. from the bottom of the legs. Cut small pieces the right length for the seat bottom and fasten with 4-penny box nails. Split one of the long 1½ to 1¾ in. pieces, dress down smooth on the split side, and cut to fit over the ends of the seat bottom. Nail it through to the seat supports with 8-penny box nails.

Sandpaper lightly with No. 1½ sandpaper. If the wood is green, let the seat dry a few days; then apply a liberal coat of boiled linseed oil with a spoonful of red paint added to each pint of the oil.

HOW TO SET UP A SMALL GRINDER

for Truing Lathe Centers

By **HOLT CONDON**



A lathe properly protected from abrasive dust while grinding the hardened center. The grinder itself is a homemade one

NO MATTER how carefully and expertly a machinist operates a lathe, he finds it necessary occasionally to repair the damage caused to the centers by wear and accident. The amateur mechanic finds it equally essential to have a ready means of reforming the 60-deg. points, which must be perfectly true if accurate turning operations are to be attempted.

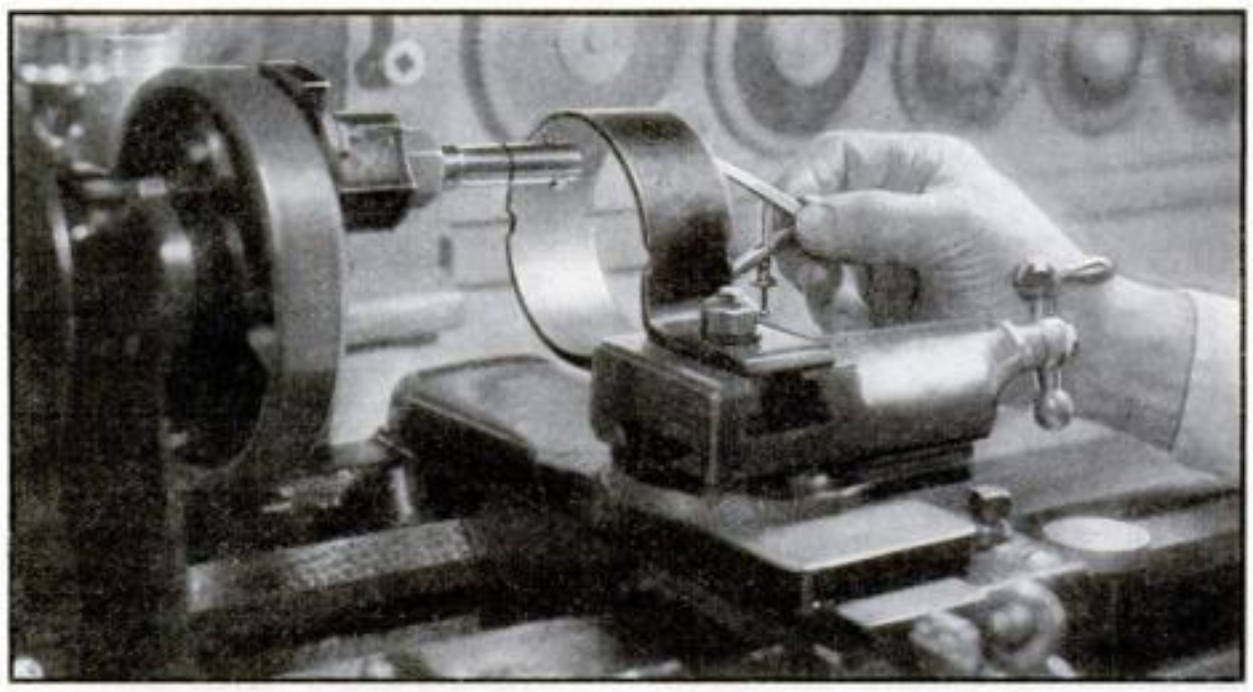
The center used in the live spindle, if soft, may be turned off in its working position, after which it should be prick-punched in place, and the sleeve and spindle nose similarly marked in order that they may always be returned to the same relative positions—a practice which compensates for any inaccuracy that may have developed in the tapers.

The hardened tail (or "dead") center gets most of the abuse and had best be reconditioned by grinding. This should be done promptly even if the damage is slight, as it can then be accomplished easily and quickly in the lathe itself. The one disadvantage in this method is the danger that abrasive dust will get into the sliding surfaces of the machine and there continue to cut. One of the accompanying photographs shows this center grinding operation under way with the lathe suitably protected. A sheet of heavy paper, which covers the finished parts, is held in place by a square of cardboard or wall board with a hole cut to fit snugly over the projecting headstock bearing. A second piece of the board is run on the threaded nose of the spindle to screen the bearing still more completely.

The little grinder is admittedly a makeshift and represents a minimum in this type of equipment, although it has taken care of this and other light grinding jobs, such as refacing valves and tappets, quite satisfactorily. The motor with a frame 3 in. in diameter is from an electric fan. Alundum, grain 3846 and grade or hardness K, is the abrasive used in the wheel, which has a diameter of 1½ in., a ⅜-in. face, and a ¼-in. hole.

The little arbor on which the wheel is mounted was turned and bored, then tapped for a set screw which seats on the flattened motor shaft. A fiber washer working against the motor frame offers a means of taking up end play.

The strap, which at once locates the grinding wheel in the proper position with respect to the work being ground and clamps the motor rigidly to the lathe compound rest, was first forged into shape. Then, with the ends clamped in the T-slot by means of a ⅜-in. stud, it was bored to fit the motor frame. This operation is illustrated in the second photograph. Since the strap was clamped on shims in its actual working position, the hole generated was not only round but coincident with the line of lathe centers. This advantage,



Calipering the strap during the boring operation. The strap was first forged into shape; then the ends were clamped with a stud in the T-slot while it was bored to fit the motor frame

coupled with the limited swing of the lathe, which prevented the strap from being fastened to the faceplate, seemed to justify making a special boring bar.

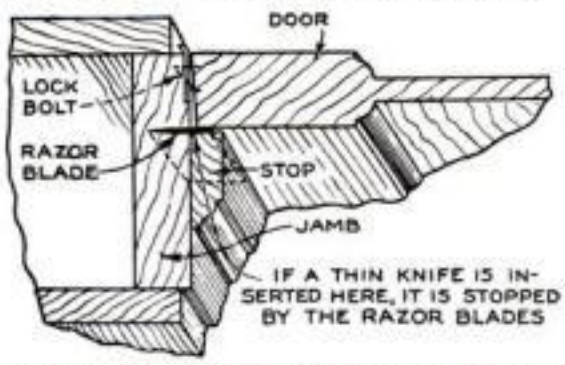
The flanged casting that forms the base of this boring tool came from the scrap pile. The flange, which has two elongated holes through it, was faced off, and the casting was tapped with a 5/8-in. S. A. E. thread. The bar, made from a 5/8-in. cap screw, was turned down and threaded to receive a 9/16-in. boring bar tip, and is held in position with a lock nut. Two 7/16-in. cap screws passing through the faceplate slots, with nuts run on the back, serve to attach the device and allow a wide swing—or none at all. There was no sign of chatter in the hole and the tool has since proved of general utility.

The writer's desire for better grinding equipment has been tempered by a reluctance to put general grinding work into the lathe, which after all is an abuse of it.

Another article in this series, which began in the November, 1931, issue, is scheduled for early publication.

RAZOR BLADES PREVENT FORCING DOOR LOCKS

IT IS no secret that ordinary cylinder locks, night latches, and electric door openers can be forced when installed on a door which has the common type of so-called "loose" stops and not a solid, rabbeted jamb. Any thin instrument—a long-bladed knife or the like—may be slipped between the stop and the jamb and used to press against the beveled or rounded surface of the lock bolt, causing it to slide back and unlock the door; or, if



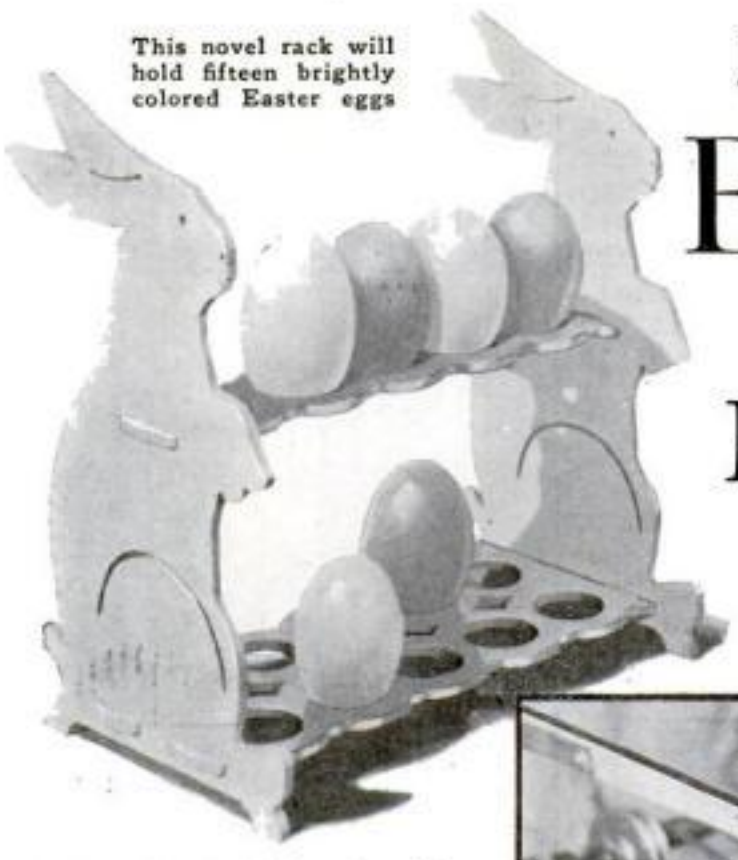
Several old blades are forced into the door jamb in such a way as to guard the lock bolt

the dead bolt is thrown, a hack saw may be slid through and used to sever it.

To prevent this, discarded safety razor blades may be forced into the jamb in such a manner as to block the crack or joint between jamb and stop as shown in the accompanying sketch. Three or four single-edged blades should be set snugly against the stop and driven into the jamb until only about 1/4 in. is left projecting to cover the crack. A section of hack-saw blade 3 or 4 in. long may be used instead of the razor blades, if preferred. Neither the razor blades nor the saw blade can be dislodged easily.—JAMES THOMAS.

REMOVING WOOD FILLER

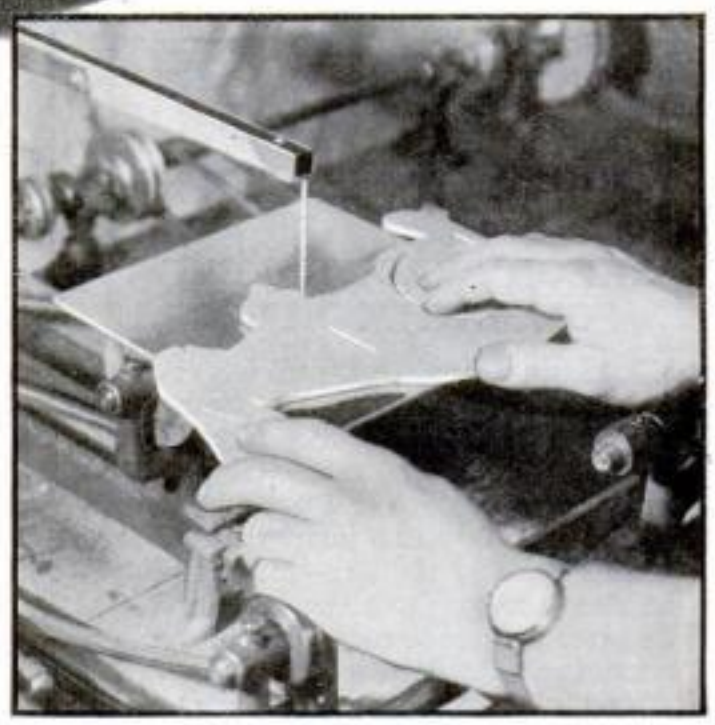
A RUBBER sink scraper or a rubber window squeegee is an effective tool for removing excess paste wood filler from flat surfaces. If a sink scraper is used, hold it near its bottom edge instead of by the handle.—GEORGE V. BAKER.



This novel rack will hold fifteen brightly colored Easter eggs

JIG-SAWED

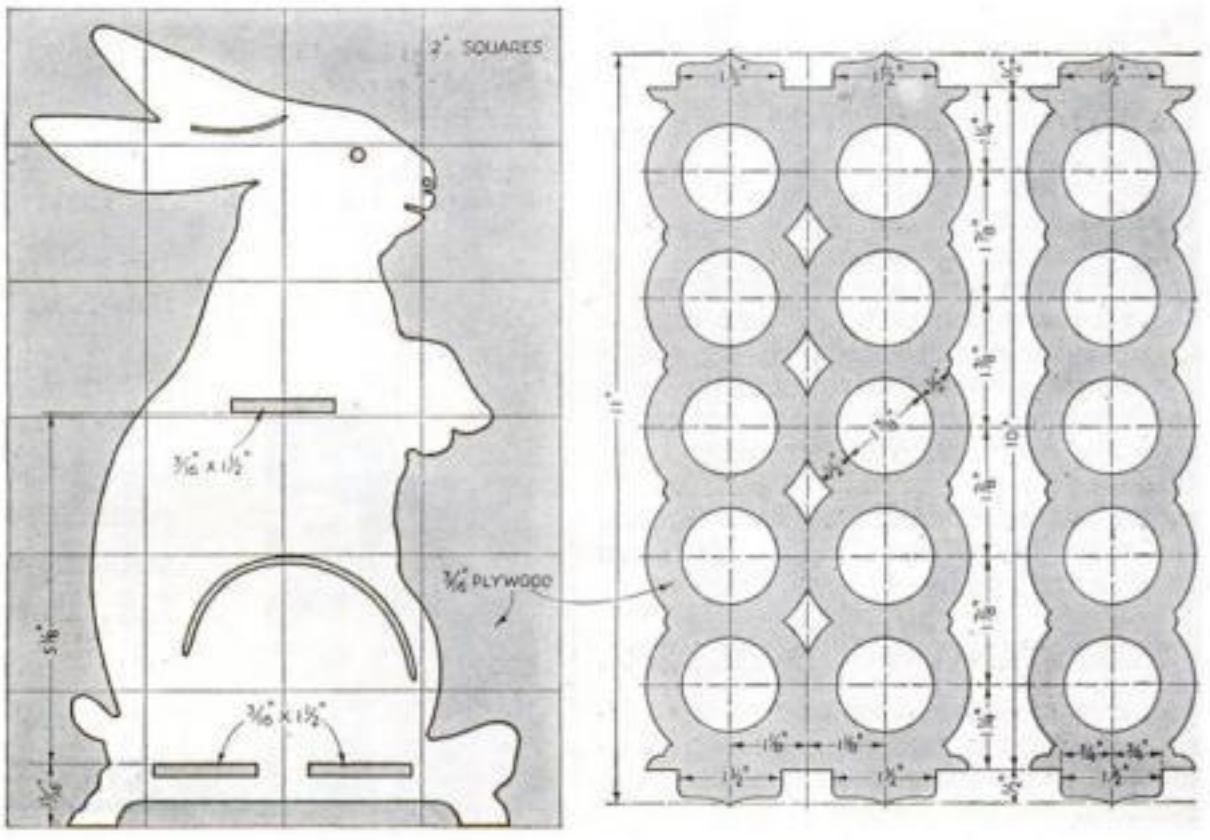
Bunnies *hold* EASTER EGGS



FOOT-HIGH rabbits, jauntily sitting on their haunches, form the ends of this unique rack for holding brightly colored Easter eggs. Although the rack illustrated was designed to hold fifteen eggs, the number can be altered to suit by changing the dimensions of the two rack pieces.

The parts are cut from 3/16-in. plywood. First, prepare a full size outline of the rabbit. This can easily be done by laying out the lines given in the drawings below on full size 2-in. squares. If the outline is sketched on heavy paper and carbon tissue is used to transfer the lines to the wood, one drawing will serve for both bunnies. The rack pieces can be laid out full size by following the dimensions given.

Before cutting the parts to shape, holes must be drilled at the starting point for each inside cut. The eyes and nose are also small holes. Be sure that the drawings for the tenons on the egg holders match the mortises in the bunnies. Glue and small brads will serve to hold the parts together. The brads for the bottom rack can be driven up from the underside of the bunny, and those for the upper rack can be driven in at an angle from the inside. As to coloring, the author found that flat white paint gives the most satisfactory effect.—MORTON C. WALLING.



How the bunnies and the racks are cut. The 2-in. squares are for convenience in enlarging

april 1932

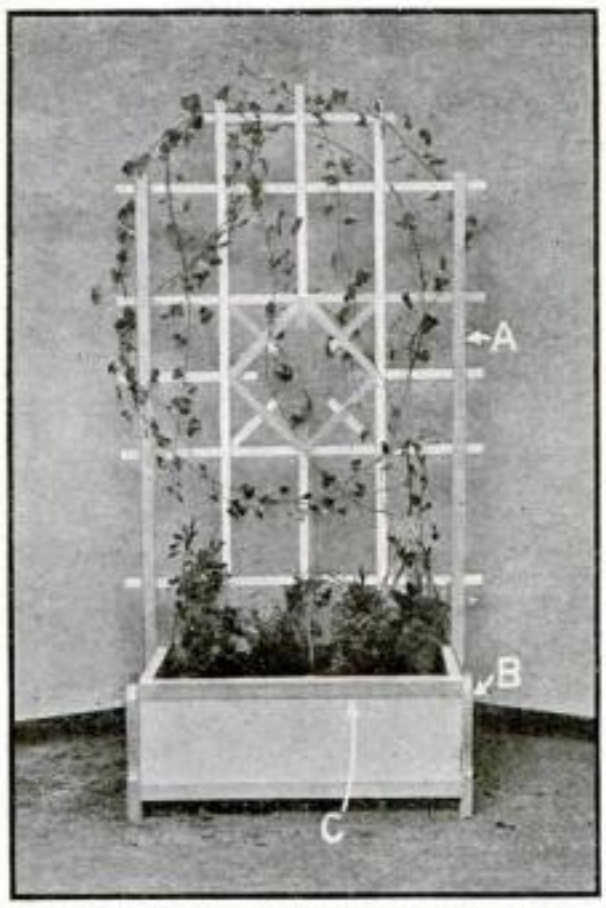
TRELLISED FLOWER BOX FOR VINES

A COMBINATION flower box and trellis like that illustrated allows vines to be grown indoors or in special locations outdoors such as on a flagstone terrace, a porch, or the roof of an apartment house.

An old packing box about 10 by 13 by 28 in. was used for the lower part. The rear upright pieces *A* were made of ⅞ by 2½ by 54 in. stock. The edge of each front piece *B*, ⅞ by 3½ by 12 in., was curved like a cabriole leg. All four pieces were nailed to the ends of the box so as to extend 2 in. below for feet. Pieces *C*, ½ by 1¼ in., were cut to go at the top and bottom of the front of the box and at both ends, and were nailed in place with threepenny nails.

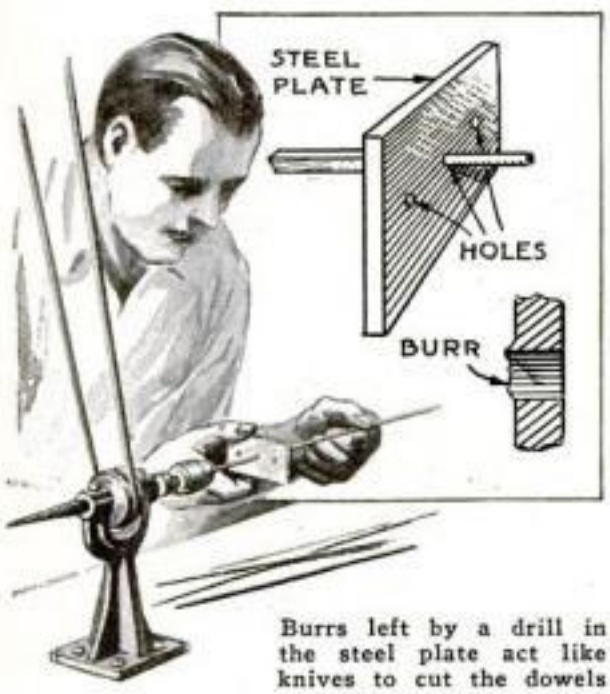
The trellis required about 40 lineal feet of ½ by 13/16 in. stock. Cut to the required lengths to form the design, the cross strips were nailed to the back of pieces *A*, and the vertical pieces and the central design were fastened with 1-in. nails driven slantingly, two in each joint. The whole was given two coats of white lead and oil, and the edges of *A* and *B* and the faces of pieces *C*, as well as some of the bars, were painted a light green.

The box may be filled with earth and plants grown as usual, or potted plants may be placed in it and the vines trained to run over the trellis, with smaller plants to trail decoratively over the edges of the box. The box will last longer if the latter method is followed since the wood will not be subjected to the rotting effect of the moisture in the earth.—C.A.K.



An old packing case provides the foundation for this attractive flower box and trellis

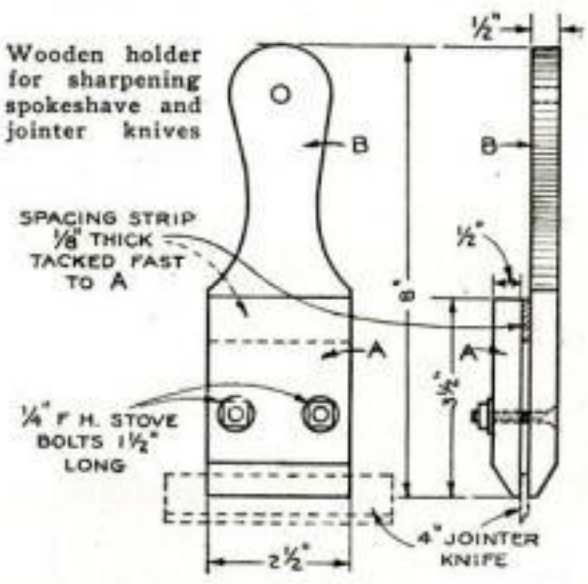
TURNING THIN DOWELS FOR MODEL WORK



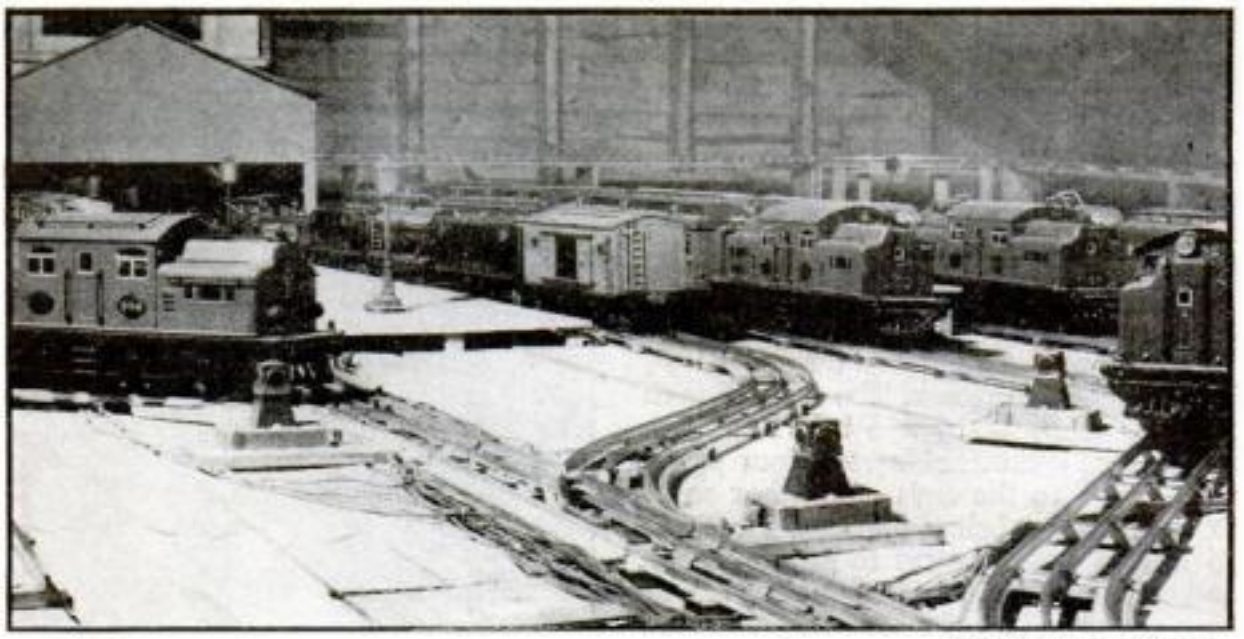
Burrs left by a drill in the steel plate act like knives to cut the dowels

DOWEL stock in diameters of ⅛ in. and less, such as is often needed for model work, can be prepared by the following method: In a piece of steel 1/16 in. or more thick, drill several holes, one the same diameter as the dowels are to be and the other progressively larger by slight degrees. Do not remove the burrs left by the drill. If tool steel is used, harden it. Cut the wood into square shapes about 1/64 in. larger across the flats than the finished diameter. Then place the wooden pieces one at a time in a small motor-driven chuck of some kind and go over each with a file a few times in order to remove the square corners. Use the other hand to steady the stock. Next run on the steel piece, burr side first, starting with the largest hole. Repeat with the next hole and continue until the stock is reduced to the right size. The burrs will do the cutting, and the smooth part of the hole will keep the diameter within close limits for the entire length of the piece of stock.—WILLIAM C. ROEMER.

HANDLE HOLDS JOINTER KNIVES FOR HONING



MOST home workshops do not have facilities for grinding small jointer knives accurately, but the knives can be kept in good condition by honing them occasionally on an oilstone. As they are awkward things to handle, I made a clamp of hardwood, as shown, to hold them. It is equally useful for holding spokeshave cutters for sharpening.—H. N. ROWLAND.



A layout being developed from stock parts

EXPANDING YOUR Model Railway

By THOMAS W. ARNOLD

"AT PRESENT I have two locomotives, some passenger and freight cars, a couple of switches, and enough track to make quite a large oval shape. What I want to know is, what is the next step in this model railway game? What shall I do now?"

That question, with minor variations, occurs far more frequently than any other in letters from model railway enthusiasts. Perhaps the best answer is to point out the possibilities and let you decide for yourself which branch of the game is most likely to appeal to you and meet your requirements as to space available, expense, and so on. Furthermore, it will be helpful to know how these various branches fit in with your own ability and natural likes and dislikes.

All model railway activity can be divided into four main classifications. You can center your work on an elaborate track layout, spend all your time on building rolling stock, buy both the track and the rolling stock and devote your own time to working out intricate signaling systems, or purchase all your apparatus and then put in your spare time constructing realistic scenic effects.

Figuring out a good track layout on paper, as well as the actual work of tracklaying, really is a sort of civil engineering job in miniature, especially if bridges, trestlework, and tunnels are included. Very little mechanical skill is required even in the laying of steel or brass rails on wooden ties, but the work does call for a tremendous amount of patience and the ability to keep at a somewhat tedious job without yielding to the temptation to speed the work at the expense of accuracy and care.

This applies only to the laying of straight or curved track. If you go in for building complicated track formations such as double crossovers or even plain switches, you will find that mechanical skill of a high order is required.

The home construction of locomotives, passenger cars, and freight cars may or may not call for craftsmanship of a high order, depending on how you go at it. The easiest job is to make freight car bodies and mount them on trucks purchased complete. Passenger cars made the same way are more work, because the body of the passenger car is more elaborate. Either a freight or a passenger car is quite a job if you make it entirely yourself, including the trucks, axles, and wheels.

Electric drive locomotives modeled after the big electric locomotives are in a class with passenger cars plus the extra work of mounting the electric motor and fitting the drive mechanism. Of course, it is possible to make even the electric motor yourself, but I should advise against it. The best motors can be bought so cheaply that the home construction of this part is a waste of time.

The steam outline, electric drive locomotive is far harder to build than even the most elaborate passenger car; assuming, of course, that the model is to be equipped with a valve motion similar to that used on a modern locomotive and the general construction is to follow full size practice. Even the man possessed of considerable skill will find it better to start with a simple freight car and then

A BOAT FOR THE SPORTSMAN

• The Camp Mate, the new Mullins shallow draft, inboard powered motor boat, gives a new meaning to power boating. The Camp Mate runs wherever there is 10 inches of water. It goes places that motor boats or outboards have never gone before. In it you can quickly reach the fishing spots and camp sites where you've formerly had to paddle or row.

• With a 15½-foot metal hull, the Camp Mate can't puncture, snag or waterlog and it never requires caulking. Lifeboat, air chamber construction makes it unsinkable. It is powered with a 4-cylinder motor developing 12-15 hp. and speed up to 12 miles per hour. It carries you and three pals with your full complement of fishing or shooting gear. Seat backs fold down to make a comfortable bed for two.

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Please send me complete information about the New Sea Eagles.....the Camp Mate.....

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City

tackle a passenger coach before attempting a steam outline locomotive.

As for the real steam locomotive, such a job is in a class by itself, and requires a degree of mechanical knowledge and skill in the use of tools that makes building freight and passenger cars seem easy.

IN ANY event, no matter what job you expect in time to tackle, don't bite off more than you can chew right at the start.

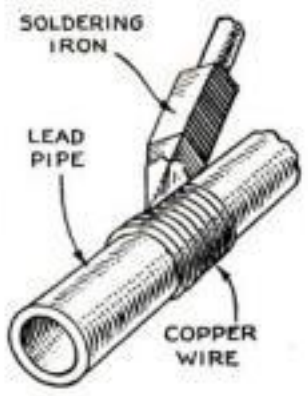
Going outside track and rolling stock construction, there is the vast field of electrical control and signaling. If problems in electric wiring fascinate you more than does the use of home workshop tools, go in for electrical control. The ex-radio fan, who built radio sets in the days when everybody assembled his own, will find himself right at home in this particular branch of model railway work, just as the fellow who likes to build ship models will find the skill thus acquired very useful in working out the details of passenger cars.

Of course, you cannot go very far in electrical control and elaborate signaling unless you have a fairly thorough understanding of elementary electricity. You should know what such terms as volts, amperes, and ohms mean, how a simple electrical circuit operates, why an electric motor runs, and so on.

THERE are many men who are fascinated by model railways but who have no particular skill in the use of tools and who haven't the faintest knowledge of electricity. It would seem at first glance that such a man might have difficulty in finding a branch of model railway activity that would appeal to him. Obviously he wouldn't enjoy attempting to lay track, build rolling stock, or tackle electrical control problems. The answer, of course, is to buy all mechanical equipment ready-made and then concentrate on working out a realistic scenic setting for the model railroad. A man with no mechanical ability is quite likely to have, as compensation, some artistic ability and, perhaps, an eye for color effects. Setting up a model railway so that at least portions of it will have a setting that looks like the real thing is easy for a man with such talents.

WIRE AND SOLDER STOP LEAK IN LEAD PIPE

A SMALL leak in a lead water pipe often can be permanently repaired by the method illustrated. First turn off the water. Then, if the pipe has become somewhat flattened at the point where it is leaking, endeavor to squeeze it back to its original shape by using a pair of large gas pliers. Clean and dry the pipe thoroughly around the leak and wrap it with closely spaced turns of clean, bare copper wire, about No. 14 gage. Apply soldering paste or acid, then flow a heavy coating of solder all over the wire turns to make a perfectly water-tight sleeve.—ARVID RYDBECK.



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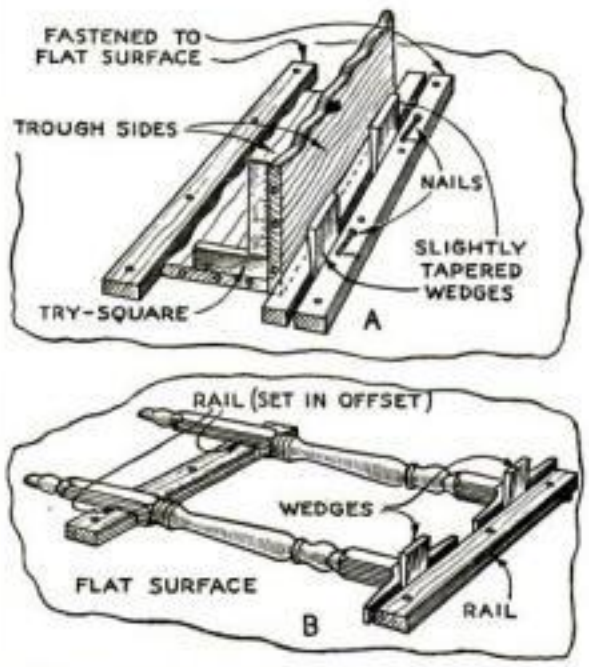
1744

This seal on an advertisement signifies the approval of POPULAR SCIENCE INSTITUTE OF STANDARDS ... See page 8

A READY-TO-ASSEMBLE BOOK TROUGH

(Continued from page 81)

can be pressed together with hand screws or clamps or by using the workbench vise, or in an improvised form made as shown at *A* below. This is prepared by nailing two strips to the bench top or some other flat surface and using a loose piece and two slightly tapered wedges to apply pressure. If well fitted, the wedges can be driven down, as shown; otherwise they



If regular clamps are not available, wedges will give the pressure required for gluing

can be inserted from the ends. Use softwood for the strips which come in contact with the trough.

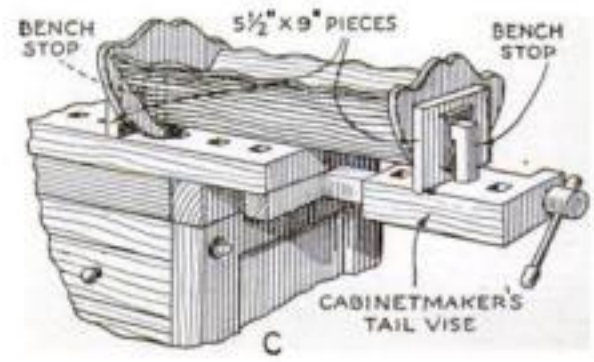
Apply glue in the dowel holes, to the dowels, and to the joining surfaces; set the trough in the improvised clamp; apply pressure with the wedges; test with a try-square to be sure the trough sides form a perfect right angle throughout the length of the trough; then fasten the wedges temporarily with nails driven at an angle. Great pressure is not necessary.

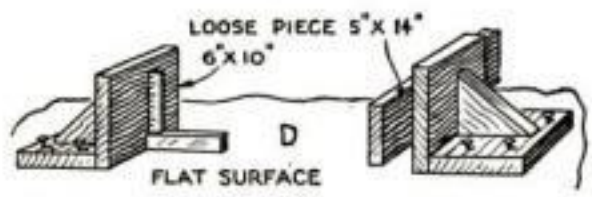
WHILE the trough is drying, glue the feet to the legs. This can be done with cabinetmaker's bar clamps, with improvised wedge clamps (see P. S. M., Mar. '32, p. 118), with hand screws (see P. S. M., Jan. '32, p. 77), or by the method shown at *B* in the drawings above. In this case the two strips or rails which serve as the gluing form have been made long enough to allow both pairs of leg posts and feet to be glued up in one operation.

The next operation is to glue the trough ends to the trough sides. Here again bar clamps will save time, if available; or the tail vise of a cabinetmaker's bench may be used as shown at *C* (at right), should you be fortunate to own a bench of this type. Otherwise you can accomplish the same result by setting up two bench brackets as shown at *D*. The brackets in this case should form a true right angle with the bench top and should be fastened at such a distance apart that the ends of the trough will be squeezed tightly against the sidepieces when the loose board (which may be a piece of softwood about 5 by 14 in.) is pressed down between one end of the trough and one of the brackets. After the form is arranged, remove the trough, apply glue as before, set it back in the form, and push the loose piece into place. Use wedges also, if necessary.

When the glue is dry, set the trough between the legs. See that the ends are accurately centered in respect to the legs and that the bottom of each end rests squarely on the offset provided. Fasten the trough temporarily to each leg post with one screw. Insert the stretcher shelf with dowels (but without glue) and arrange a convenient way to clamp the legs against the ends of the shelf—with bar clamp, wedge clamp, bench vise, or bench brackets. Then remove the shelf, apply glue as before, and complete the assembly. Drive the remaining screws and glue in the cross-grain plugs to conceal the screw heads. See that the grain of the plugs runs in the same direction as the grain of the trough ends. Sandpaper the plugs until flush with the surface.

FINALLY, remove any surplus glue, sandpaper the trough with No. 00 sandpaper, and apply the finish. You will find this in three cans marked Nos. 1, 2, and 3. Apply them in this order according to the directions on each can. For safety in shipment, screw-top cans are used, so you will find it more convenient to pour the contents into wide-mouthed receptacles, such as empty mayonnaise jars. To clean the brush used in the stain and filler coat No. 1, use lacquer thinner if available; to clean that used in finish No. 2, use turpentine; and to clean the brush





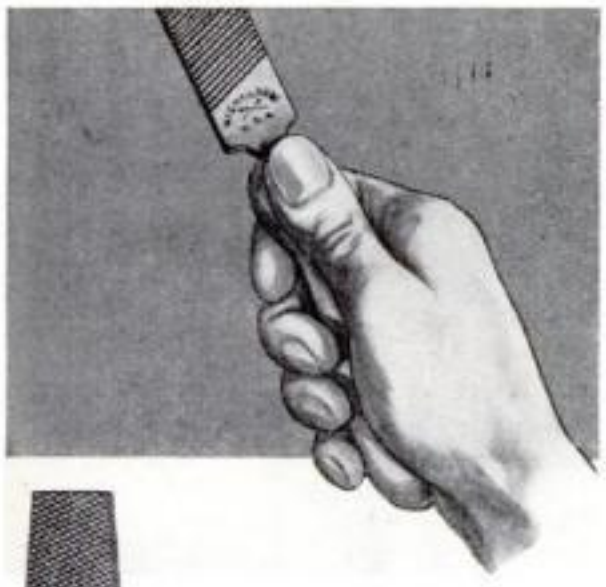
Gluing on the trough ends with the aid of a cabinetmaker's vise, and two bench brackets which are easily made for the same purpose

used for applying the gloss coat (No. 3), use denatured alcohol.

This book trough kit is completely guaranteed. If you are dissatisfied in any way, you may return the kit within ten days, provided the parts have not been marked or damaged, and your money will be refunded without question.

Three other kits are also available: No. 1, for assembling a maple butterfly table of Colonial design with an oval top 17 by 22 in., standing 22½ in. high; No. 2, for a solid mahogany tray-top table 15 in. in diameter and 23 in. high; and No. 3 for a maple tilt-top coffee table with a swinging gate, the top being 19 by 28 in. and the *(Continued on page 107)*

FIRST
GET THE RIGHT FILE



THEN GET

THE RIGHT GRIP

ON IT

GRASPING the file is important. For heavy filing you bring the handle against the fleshy part of your palm beneath the joint of your little finger. Your thumb lies along the top of the handle directed toward the point of the file.

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MAHOGANY BOOK TROUGH

(Continued from page 106)

height 21 in. The coffee table also is made in solid mahogany; if you prefer mahogany, ask for Kit No. 3A. Do not delay if you wish one of these pieces; mail the coupon at once.

KIT NO. 1

At left: A butterfly table of Colonial design in selected maple

KIT NO. 2

At right: Beautifully turned tray-top table in Honduras mahogany

KIT NO. 3

This tilt-top coffee table is to be had in both maple and mahogany

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(or send C. O. D. ☐)

- ☐ **KIT NO. 4.** Book trough in mahogany as illustrated on page 81, $5.30
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- ☐ **KIT NO. 3A.** Tilt-top coffee table in mahogany with complete instructions, $8.15
- ☐ **KIT NO. 2.** Tray-top table in mahogany with complete instructions, $5.90
- ☐ **KIT NO. 1.** Butterfly table in maple with complete instructions, $6.90

It is understood that these prices include the machined wooden parts, hardware, finishing materials, and shipping charges, and that if any kit should prove unsatisfactory, I can return it within ten days and the amount paid will be refunded at once. This offer is made only to readers in the United States.

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Aluminum Cowling *Improves* Plane Models

By J. D. STAGGS

REALISTIC looking cowling for any airplane model of the in-line engine type can be made easily from thin aluminum. In a flying model the slight additional weight at the nose allows the wing to be moved farther forward, and the speed will be greater than if the front of the ship were left open. The cowling shown in Fig. 1 is for a Liberty engine, but you can design your own to resemble the type and make of plane of which you are building a model.

Fig. 3. How straight bends are made with the aid of a rule or a thin straightedge.

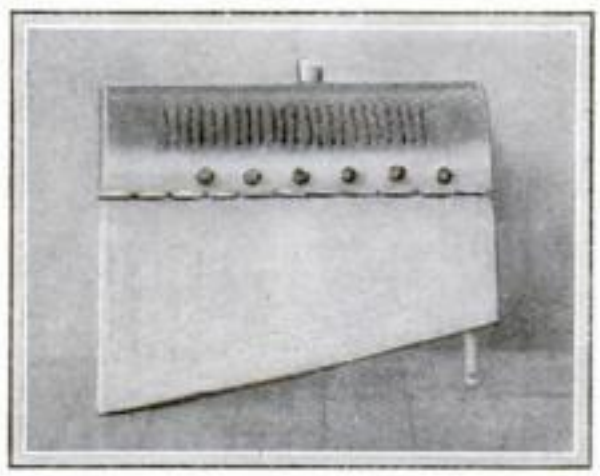

Fig. 1. The cowling has hinged sides which allow the rubber-band motor to be installed.

A stiff-backed razor blade, if broken away until a suitable length of sharp edge remains, can be used to cut the louvers in the cowling. Hold the blade as shown in Fig. 2, placing the metal on a block of soft wood in such a way that the cut will be parallel to the grain of the wood. A light blow with a small hammer will drive the edge through the metal. When all of the louvers are cut, bend each out with a pair of tweezers.

The hinges joining the sides to the top can be cut in a similar manner. When the lips are cut, bend them over a piece of small diameter wire.

Straight bends can be made as indicated in Fig. 3. Mark the stock, place it on a smooth block of wood, lay a straightedge along the mark, and bend the metal.

Figure 4 illustrates the method of installing the exhaust ports, which are of balsa wood. The radiator, also shown in Fig. 4, is made from a piece of aluminum cemented to a piece of light wood, after the shutters are cut in the same manner as the louvers in the cowling.

Since models vary in size, no dimensions are given, but it is a simple matter to lay out on paper a radiator and cowling that will be in scale with your own model and take the dimensions from the drawing.

Fig. 2. Forming louvers with a razor blade broken off to cut slits of the right length.

Fig. 4. How the dummy exhaust ports are installed (*at right*), and the radiator (*left*).

DELICATE FRETWORK FOR SHIP MODELS

INTRICATE fretwork for ship models can be cut from wood without splitting if an ordinary nonwaterproof three-ply panel is used. Draw the design, score around it with a sharp knife, and remove the waste wood down to the second ply or core stock, leaving the ornamentation in relief. Then soak the plywood in warm water to loosen the glue and free the fretwork, which requires only a little sandpapering before it is applied to the model. P. J. Hauss, of Indianapolis, Ind., used this method in building the sidepieces for the pirate galley shown on our Blueprints Nos. 44 and 45 (see page 110)

W. E. Troup, of Harrisburg, Pa., another reader who builds ship models, makes the flags and pennants stand out as if flying in a strong breeze by stiffening them with piano wire. He leaves an extra margin at the top and inner edges and, after painting and shellacking the flag, glues the margins over an L-shaped piece of music wire. One leg of the L serves as the flagstaff; the other, along the top of the flag, keeps it properly spread out.

HOW TO GET COMPLETE PARTS FOR MAKING WHALER MODEL

IF YOU are planning to build our new whaling ship model described on pages 75 to 78 of this issue, you can save yourself much time and effort by buying a complete set of the necessary materials from the Popular Science Homecraft Guild.

By extending its activities to the field of model making, the Guild has solved what has always been one of the most troublesome problems encountered by those who wish to take up the hobby of building ship models—that is, the difficulty and expense of having to shop around for so many miscellaneous small parts of unusual sizes and kinds.

Just refer for a moment to the list of materials for that model given on page 78. There are many items which ordinary dealers, especially in small towns, do not carry in stock; for example, 1/16 in. thick hardwood, 3/32 in. thick plywood, 3/16 in. diameter wooden dowels, boxwood for making deadeyes and blocks, ⅛ in. thick celluloid, and very fine chain.

Even the linen fishing lines used for rigging the model are not easy to obtain in exactly the right sizes and quality. If a sporting goods dealer does happen to have all four sizes, he cannot be expected to cut off the amount required; therefore it is necessary to buy four entire spools or lines at a cost which is likely to amount to at least four dollars.

Many a beginner who has hopefully set out to construct a model has been baffled and completely discouraged by his efforts to gather materials. With our new whaling ship model, however, this is not necessary. The Guild has assembled kits which contain all the materials listed on page 78 with the exception of the paints. The wood is cut approximately to the sizes noted, and all the supplies have been selected especially for this one purpose.

One of these kits will be sent to any address in the United States, all shipping charges prepaid, for $6.90. This includes the four whaling ship blueprints, which alone are worth $1.00. The remittance may be made with your order, or you may have the kit sent C. O. D. at the same price, if you prefer, although the former is the quicker and more satisfactory method. A coupon below is given for your convenience, but if you do not wish to cut the magazine, you may order by writing a separate letter.

Popular Science Homecraft Guild,
381 Fourth Avenue, New York, N. Y.

Please send me all the materials (except paints) required for building a model of the whaling ship *Wanderer*, and also Blueprints Nos. 151, 152, 153, and 154.

☐ I inclose $6.90.
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Name.....
(Print name very clearly)

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Note: This offer is made only to readers in the United States.

BLUEPRINTS

to Help You in Your Home Workshop

TO ASSIST you in your home workshop, POPULAR SCIENCE MONTHLY offers large blueprints containing working drawings of a number of well-tested projects. These prints are the result of a pioneer effort begun by this magazine in 1922 to provide readers with authoritative drawings at a nominal price.

The majority of the blueprints are on heavy paper 15 by 22 in. In the following list the blueprint numbers are shown in italic type immediately following the descriptive title. In ordering it is necessary to give only these blueprint numbers. Where the title is followed by one number only, the blueprint is on one sheet and can be obtained for 25 cents. Wherever there are two numbers, it means that there are two sheets in the set, and the price is 50 cents. Three numbers indicate that the set consists of three sheets and costs 75 cents. In a few cases, too, there is more than one project on a sheet. A coupon is given below for your convenience in ordering. When using the coupon, be sure to enter the numbers correctly.

Airplane Models

Bremen (Junkers, 3-ft. Flying), *89-90*	$ .50
Combination, 20-in-1, *135-136*	.50
Curtiss "Hawk" Whittled Model, *164A*	.25
DO-X Whittled Model, *163A*	.25
Fokker D-7 Whittled Model, *166A*	.25
Lindbergh's Monoplane (3-ft. Flying), *69*	.25
Rise-off-Ground Tractor, 3-ft., *50*	.25
Seaplane, Tractor, 30-in., *87*	.25
Seaplane, Morris (Record 12½ min.), *102*	.25
Single Stick, Tractor, 30-in., *82*	.25
Tractor (Record Flight 6,024 Ft.), *104*	.25
Twin Pusher, Racing, 35-in., *86*	.25
Winnie Mae (4-ft. flying), *141-142-143*	.75

Boats

Canoe, Sailing Outfit, *25*	.25
Outboard Racer, 11½-ft., *128-129*	.50
Sailboat-Motorboat, Combination (15 ft.), *131-132-133*	.75
13-ft. Rowboat-Motorboat, *147*	.25
14½-ft. Rowboat-Motorboat, *148*	.25
16-ft. Rowboat-Motorboat, *149*	.25
Stern Drive Installation (When used with Rowboat-Motorboat), *150*	.25

Furniture

Bookcase, Modernistic, *88*	.25
Bookcase, Simple, *37*	.25
Book Ends, Modernistic, *100*	.25
Bookshelf, Modernistic, *100*	.25
Bookshelves, Hanging, *77*	.25
Bookstand, Modernistic, *88*	.25
Book Trough, *68*	.25
Broom Cabinet, *49*	.25
Cedar Chest, Mahogany Trimmed, *17*	.25
Chair, Rush-Bottom, *36*	.25
Chest of Drawers, Salem, *39*	.25
Chests, Treasure, *78*	.25
Clock, Grandfather, *19*	.25
Desk, Colonial, *21*	.25
Desk, Flat Top, *20*	.25
Desk, Sheraton Writing, *40*	.25
Dresser, Welsh, *60*	.25
End Table, Magazine, *68*	.25
Kitchen Cabinet, *5*	.25
Kitchen Table Cabinet, *27*	.25
Lamps, Modernistic, *93*	.25
Mirror, Scroll Frame, *105*	.25
Pier Cabinet, *77*	.25
Radio Cabinet, Console, *70-71*	.50
Screens, Modernistic Folding, *91*	.25
Sewing Cabinets, Two, *31*	.25
Sewing Table, *1*	.25
Shelves and Lamp, Modernistic, *93*	.25
Shelves, Corner, *77*	.25
Smoking Cabinet, *2*	.25
Stand, Low Modernistic, *100*	.25
Table, Gate-Leg, *24*	.25
Table, Sheraton, *38*	.25
Table, Tavern, *105*	.25
Table, Tilt-Top, and Bench, *11*	.25
Table, Tilt-Top, Oak (Top 20 by 24 in.), *140*	.25
Tea Wagon, *13*	.25
Telephone Table and Stool, *18*	.25

Radio Sets

Amplifier, Three-Stage, Audio-Frequency, *42*	.25
Five-Tube (Battery Operated), *54-55*	.50
Four-Tube (Battery Operated), *43*	.25
Full Electric Headphone Set, *130*	.25
One Tube (Battery Operated), *103*	.25
Screen-Grid Set, *109*	.25
Short-Wave Converter Unit, *137*	.25
Amateur Short Wave Receiver, *155*	.25

Ship and Coach Models

Barque, Scenic Half-Model, *108*	.25
Bottle, Clipper Ship in, *121-122*	.50
Clipper, Baltimore (8-in.), *92*	.25
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Constitution ("Old Ironsides"), *57-58-59*	.75
Covered Wagon, *118-119-120*	.75
Destroyer—U. S. S. *Preston* (31½-in. Hull), *125-126-127*	.75
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Mayflower (17½-in. Hull), *83-84-85*	.75
Motorboat, 29-in. Toy, *63-64*	.50
Ocean Liner *Bremen*, *158A*	.50
Pirate Galley or Felucca, *44-45*	.50
Roman Galley (19-in.), *138-139*	.50
Santa Maria (18-in. Hull), *74-75-76*	.75
Schooner—*Bluenose*, *110-111-112*	.75
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Stagecoach (Cody), Small, with Horses, *144-145-146*	.75
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Whaling Bark *Wanderer*, *151-152-153-154*	1.00
Yacht, *Sea Scout*, 42-in. Racing, *106-107*	.50
Yacht, 20-in. Racing, *48*	.25

Toys

Airplane Cockpit with Controls, *114*	.25
Birds and Animals, *56*	.25
Broncho, Doll's House, and Train, *14*	.25
Doll's House, Colonial, *72*	.25
Doll's House Furniture, *73*	.25
Drill Press, Woodturning Lathe, Jointer, and Circular Saw, *113*	.25
Dump Truck, Sprinkler, Fire Engine, and Tractor, *101*	.25
Garage, Tea Wagon, and Wheelbarrow, *29*	.25
Lindbergh's *Spirit of St. Louis*, *67*	.25
Play Table, Pullman, *28*	.25

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Arbor, Gate, and Seats, *9*	.25
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Garage, One-Car, Pergola, *23*	.25
Log Cabin (Three Rooms), *134*	.25
Model of Old *Fort Union*, *160A*	.50
Puzzles, Six Simple Block, *65*	.25
Swing, Porch, *10*	.25
Tool Cabinet, Bench Hook, and Boring Gage, *30*	.25
Trellises, Garden, *34*	.25
Workbench, *15*	.25

Popular Science Monthly
381 Fourth Avenue, New York

Send me the blueprint, or blueprints, numbered as follows:

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No..... No..... No..... No.....
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Note: Please print your name and address very clearly. If you do not wish to cut this page, order on a separate sheet.

MAKING COLORS BEHAVE IN YOUR PHOTOS

(Continued from page 90)

the girls had peaches-and-cream complexions. Freckled faces, which often go with red hair, photograph on color-blind film with an appearance that strongly suggests smallpox or some other horrible disease.

Later on it was found that the relative sensitiveness of plates or films to the different colors could be modified by adding certain dyestuffs to the coating. First came orthochromatic plates or films which are much more sensitive to green and several other shades of color than the original color-blind variety. Orthochromatic plates or films, although they are not much affected by red light, are sufficiently red-sensitive to require more careful handling in development. The bright red light that is safe with color-blind film will fog the fast orthochromatic varieties, and a much dimmer light has to be used.

The next development was panchromatic plates and films. Such film is sensitive to all colors of light and in the latest supersensitive type is even a trifle more sensitive to red and orange colored light than it is to blue. Panchromatic film is now widely used in motion picture studios, and its more accurate rendering of color values in shades of gray has brought several *(Continued on page 112)*

$10 *for the best* Photograph Showing COLOR CONTRAST

For the most photographically perfect picture showing color contrast submitted on or before May 2, 1932, POPULAR SCIENCE MONTHLY will pay $10. The only condition is that it must be taken during the months of March and April, 1932, by an amateur. Any type of camera may be used, and the developing and printing may be done by a professional. Mail both print and negative to the Photographic Editor not later than May 2, and mark your entry "April Photo Contest." If you wish the print and negative returned, send a self-addressed, stamped envelope.

Winner of Seventh Contest

J. M. Stofan, Garfield, N. J., has been awarded the $10 prize for the best picture in the photographic contest announced in the seventh article in the series (P. S. M., Dec. '31, p. 90). Those entrants winning honorable mention are as follows: Cecil E. Betzer, Riverside, Ill.; George Carlson, Bridgeport, Conn.; C. H. Clapper, Hudson, N. Y.; Wilton Fisher, Tulsa, Okla.; A. E. Gensch, Baltimore, Md.; K. W. Given, Manhattan, Kans.; Norman B. Hoyt, Taneycomo, Mo.; W. Keller, St. Joseph, Mo.; W. J. Leonard, Cincinnati, Ohio; Victor F. J. Lind, Cincinnati, Ohio; Martin Mathewson, Toronto, Canada; R. B. Maxey, Columbia, S. C.; Clarence J. Mayer, Buffalo, N. Y.; E. E. Scott, Pittsfield, Mass.; Chr. Walton, Tampa, Fla.; Oscar Welander, Palm Beach, Fla. The January contest winner will be announced next month.

MAKING COLORS BEHAVE IN YOUR PHOTOS

(Continued from page 111)

changes. Make-up, for example, now looks more natural.

It is interesting to note that the mouth-filling names "orthochromatic" and "panchromatic" are derived from the Greek words *chromaticos,* which means suited for color, *orthos,* meaning straight, and *pan,* which means all. Literally, then, orthochromatic would mean straightly suited for color and panchromatic would mean suited for all colors. Perhaps, if the inventors of orthochromatic plates and films had known that still more color sensitive material was to come, the panchromatic type, they wouldn't have given their invention such an all inclusive name. The derivation of "verichrome" is obviously similar, with *veri,* coming from the Latin *verus,* meaning true.

The illustrations on page 90 bring out the differences between panchromatic film and the old color-blind variety. The photograph at the top of the page is of a plate placed on a luncheon cloth with a light blue striped border. The objects on the plate are a green pepper, an orange, an apple, a lemon, a tomato, and a bunch of grapes. You may recognize them by their shape, but you certainly won't by their color, for instead of reproducing as various shades of gray that represent the intensity of the color of the original objects, they are as black as so many lumps of coal. This picture was taken with commercial type film of the color-blind variety used by professional photographers where color rendering is of no importance. Even the cheapest roll film you can buy for your snapshot camera is much more orthochromatic than this plain commercial film.

NOW look at the photograph immediately below the first one and see how the same subject looks when photographed on supersensitive panchromatic film. Note the light color of the lemon and orange, how natural the apple looks, and how even the dark green of the pepper has registered as a corresponding shade of deeper gray. The tomato, which with color-blind film looks like nothing so much as a piece of polished ebony, shows with the panchromatic film as a lighter gray that suitably represents the brilliant, light red of the original.

These two photographs were taken without changing the camera or the lighting in any way; no color filters were used with the panchromatic film, and the two negatives were developed in the same developer.

Those of you who recall the cover picture on POPULAR SCIENCE MONTHLY for last September will remember the deep-sea diving scene with a bright red diving machine shown against a dark blue, almost black background and the brilliant lights from the diving machine throwing a flood of bright yellow light across the sea bottom as the machine's mechanical arm picks up the treasure chest. The words "POPULAR SCIENCE MONTHLY" appeared at the top of the page in vivid yellow with the rest of the lettering in white.

The left-hand illustration at the bottom of page 90 shows what you get when you try to photograph such a picture with color-blind film. The deep blue comes out a sickly gray, and the brilliant yellow lettering is so dark that it merges with the background. The diving engine also is nearly the same shade as the background, while the effect of brilliant lights on the sea bottom is suppressed. Now look at the second photograph of this pair and note what supersensitive panchromatic film does for the same subject. The result is obviously a much better reproduction of the original.

What has all this got to do with taking a snapshot of little *(Continued on page 113)*

A definite program for getting ahead financially will be found on page four of this issue

MAKING COLORS BEHAVE IN YOUR PHOTOS

(Continued from page 112)

sister standing in front of some dense foliage? Just this: The more you know about how colored objects photograph, the better pictures you will be able to take.

Unless you are an advanced amateur photographer with elaborate equipment, you will have a roll-film camera, and your choice of film will therefore be limited to standard film or the verichrome type. The latter is the latest thing in roll film for amateur use and is very highly orthochromatic. While it cannot equal panchromatic film in registering all colors, being relatively insensitive to red, it does a far better job of it than the standard film. This is especially true of the colored objects the amateur is most likely to photograph, such as the green of foliage. Furthermore, the use of the yellow filter in taking cloud pictures is much more effective on verichrome type film than it is on standard film. The exposure does not have to be increased so much, and the clouds are more strongly brought out.

Readers have asked why panchromatic film is not available in ordinary rolls to fit the standard sizes of cameras. There are, so far as I know, no physical reasons why panchromatic film could not be put out in rolls like any other film, but there is one apparently insurmountable practical obstacle. The film-finishing establishments of the country are all equipped to handle film with the aid of red dark-room lights. Panchromatic film of the supersensitive type has to be handled and developed in total darkness, and there is no sense in the manufacturers' turning out "pan" film in regular sized rolls if the photo finishers are not prepared to handle it.

Another photographic article will appear in the May issue.

MOCCASINS FOR YOUR NEXT VACATION

(Continued from page 80)

crossline and measuring ¼ in. toward the toe on the side lines. Connect these points with a line. Then draw lines 1½ in. long from the inside points and parallel to the side lines. A curve drawn from the inside end of one of these short lines to the point of the heel and then down to the end of the other short line completes the heel.

The toe piece or tongue is drawn on the same piece of cardboard and is the same general shape as the toe curve of the main piece. The pattern should be about ¼ in. smaller all around than the actual toe tracing, but it is best to have it meet the tracing where the line *CD* crosses it. The tongue part can be made as long as the maker desires, but for comfort should not be less than 1½ in. beyond the crossline.

Preparing Leather. Cut out the two patterns and trace them on the leather. Turn them over and trace them again. This will make a set for the right foot and one for the left foot. With a sharp knife, cut the leather exactly along the lines. The toe curve on the main piece and the toe curve on the tongue are beveled on the inside—that is, on the flesh or rougher side of the leather—to an angle of 45 deg. The heel curve and inside edges are also beveled 45 deg., but the rear ends of the tabs are only slightly beveled—less than 45 deg.

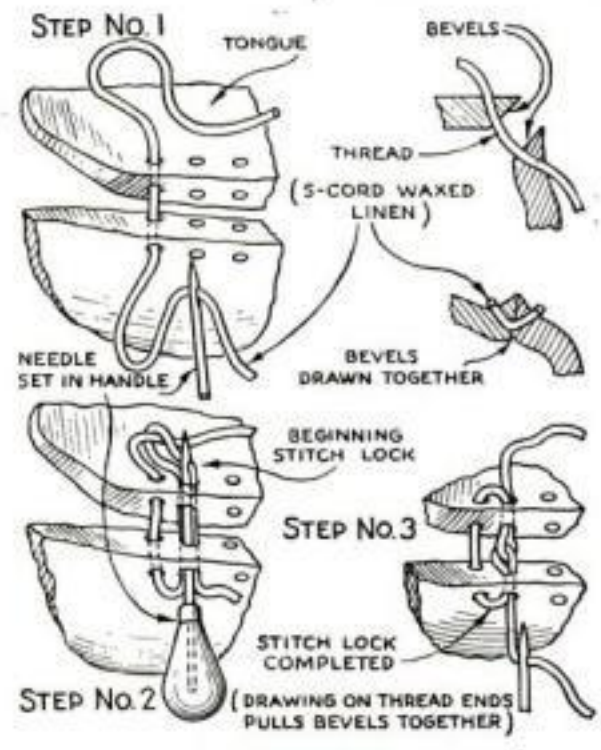
Six holes for laces are punched on each side of the main piece in pairs ¾ in. apart. The first pair is ½ in. and 1¼ in. from the back end of the heel tabs; the second pair is the same distance from the front crossline *CD*, measured *(Continued on page 114)*

MOCCASINS FOR YOUR NEXT VACATION

(Continued from page 113)

toward the back; the third pair is placed halfway between the others. One hole is punched on each side of the tongue ¼ in. back of the crossline if the lacing is to be as shown in the upper photograph on page 80, which the writer prefers; or four holes may be punched as indicated in one of the drawings. All holes are ¼ in. from the edge.

Draw a line on the hair, or smooth, side of the leather around the edges that have been beveled, ⅛ in. from the edge. This is a guide line for the holes that are to be put in with the awl for the sewing. Along the line on the tongue, punch holes ⅛ in. apart with the awl. Start the holes on the line



Step No. 1. Pass thread through first set of holes. Have about 18 in. of thread each side of holes. Step No. 2. Pass needle through second set of holes; then draw it back about ½ in. to form a loop. Pass free end of thread through loop. Step No. 3. Draw needle back and pull thread ends tight

and make them come through in the bevel, near the bottom of it.

Count the holes in the tongue and space off an equal number on the toe. These holes will be more than ⅛ in. apart.

Punch seven or eight holes in the ends of the heel tabs; also punch holes down the inside edges of the tabs ⅛ in. apart. Count these holes—both tabs—and space off an equal number on the heel curve.

Sewing. The heel tabs are sewed together first, and the thread tied tightly. Then, starting at one end of the heel curve, sew the parts together, using every hole in order. Pull the thread tightly, pucker the leather a little if necessary, and work the heel up round with the thumb. The tongue is sewed in last; start at one end and work around the holes in sequence to the other end. The kind of stitch used is illustrated above. If the leather is a little stiff and does not pucker up readily, it should be saturated along the edges with neat's-foot oil.

Lacing. The lacing is started by passing the two ends of the lace through the two holes in the heel—one each side of the center seam—and drawing them out until the ends are even. Each of the ends is passed out and in alternately through each succeeding hole. When the lace ends reach the front holes, they will be coming out from the inside of the moccasin. Pass them through the holes in the tongue and down between the lace and the moccasin next to the second hole from the front, then back up, where the ends are tied in a bowknot on top of the tongue (see upper photograph on page 80).

April 1932

SEEING WORLD WITH FLYING CAMERA

(Continued from page 29)

twenty-five more pictures of the city below. Then they dove out of the thin air to safety.

Contrary to common belief, air mapping cameras take still pictures just like ordinary hand cameras. The prints are later pieced together like a mosaic to form the complete map. An overlap of sixty percent is allowed on each picture taken. This means that every spot on the territory being mapped is photographed twice as a double check for accuracy.

IN THE air, the operator snaps the shutter once every so many seconds. He determines the time between exposures by means of a small rectangular pane of glass marked with crosswise and lengthwise lines. As the pilot heads down the course to be mapped, the photographer looks at the ground through this glass and takes the time required for an object below to pass from one crosswise line to another. He uses that as the time interval between exposures. When mapping a long course, he usually checks up on the interval once or twice along the way to be sure the wind has not shifted, either increasing or decreasing the speed of the plane in relation to the ground.

One time, a couple of years ago, a photographer checked up four times on a twenty-mile course to be sure the wind hadn't shifted. Then, when we landed, he found he had forgotten to take out the sun shade, an aluminum slide which protects the film when the camera is not in use, and consequently had not recorded a single picture!

Another time, the joke was on me. Mechanics had just finished putting oil in the engine when I hopped off. On the long climb to 19,000 feet, I was busy with the instruments. At the peak of the climb, I looked down to line up my course with objects on the ground. The outside of the window in the floor of the cockpit, through which this is done, was covered with spilled oil. I couldn't see a thing. There was no way to wipe the oil off. So we had to come down and start all over again.

IN MAP flying, a pilot uses Geological Survey charts as a guide. They show every house and hill. By comparing objects on the chart with those on the ground, he flies in straight, parallel lines back and forth over the territory being mapped. If he wanders off the line, there will be gaps where the parallel strips fit together in the final mosaic. Recently, I made a map over Connecticut in which I did all the piloting by compass, without looking at the ground at all. The easiest air map flying I ever did was over Kansas. Here, the line fences and roads on the flat prairie-land run north and south or east and west, and following a course is simple.

However, this does not eliminate the photographer's worries. Two years ago, I was on a mapping job out of Wichita for an oil company. We waited more than a week for good weather. Then, one afternoon about two o'clock, it cleared off. To get the right light, pictures must be taken between 9:30 A.M. and 3:30 P.M. So our time was short. We hopped off into a steep climb. At 16,000 feet, I headed down the course.

The photographer was bending over the "clicker" in its cradle. A minute later, a riot broke out behind me. The camera man was waving his arms and shouting: "Go home! Go home!" You could have heard him above the Battle of the Marne. When I looked back over my shoulder, he was pulling his hair and trying to jump up and down. The ninety-foot roll of film in the camera had become twisted and jammed.

A thing I have noticed is that both pilots and photographers become more irritable the higher they go. Take the best-natured man in the world 19,000 feet in the air and the depressing effect of a lack of oxygen will make him touchy.

Sometimes, I feel better at high altitudes than at others; but, almost always, I come down with a violent headache. Thin-air piloting is a constant strain. To keep the ship in the sky, you have to race the motor at top speed, and to hold the course and keep the wings level, you have to concentrate upon the instruments until you are dizzy. Besides, it is piercingly cold up there, even in summer. On the average, the temperature drops one degree for every 300 feet you ascend. At 19,000 feet, it is often more than sixty degrees colder than on the ground.

During a high mapping flight, I glance back at the photographer every few minutes. If I see him sitting down with his mouth open, looking white around the gills, I know he is ready to "pass out" in the thin air and dive to 16,000 feet to bring him to. Then we go back up again. You can make steeper dives at higher speeds in thin air than near the ground without subjecting the wings to pressures greater than they can stand.

WHEN I feel myself getting faint, I always lean far back in my seat during the dive. This is to prevent me from falling forward onto the controls and putting the ship into an outside loop in case I go out altogether. The highest I have ever flown in air mapping is 21,500 feet. Above that, oxygen tanks are necessary.

A few months ago, in mapping a pipe line for a natural gas field between Binghamton and Elmira, N. Y., I was guiding my course by aiming at a distant ridge of hills. All of a sudden, the hills disappeared. I glanced at my instruments. What I saw looked like a picture taken out of focus. Then I knew it was time to dive down for a little more oxygen.

It is only on certain days that air mapping can be done. There must be bright sunshine and no haze. Sometimes you wait for weeks before the right day comes. During such delays, the pilot draws his base pay just the same. On one job, last summer, we were held up five out of eight weeks by bad weather.

Even a single cumulus cloud, floating in a clear summer sky, may cause trouble by leaving a "cloud gap" in the picture. These clouds are found between 4,000 and 12,000 feet above the earth. All photographic work in mapping takes place much higher, so when such a cloud is floating directly below it cuts out an area of ten square miles or more in the resulting picture. Such gaps have to be retaken later and pieced into the finished mosaic.

IN THE spring of 1930, I was mapping the Potomac River, near Washington, D. C., in a Wasp-Fairchild "71." Near the end of our course, cumulus clouds began drifting in ahead of us. We tried to push through and beat them, but they came in too fast. When the film was developed, it showed three large "cloud gaps," and we had to climb up and retake those areas. In order to "beat the clouds to it," we always keep our mapping plane at the field nearest the spot where the camera work is to be done.

A new type of air-map camera, using glass plates instead of film to avoid the slightest distortion due to shrinkage or expansion, has been developed for producing contour maps, showing the elevation of hills and valleys, direct from aerial photos. Two glass negatives, showing the same section of territory taken from slightly different angles, are inserted in an elaborate apparatus called an "aerotopograph."

Looking through (Continued on page 116)

SEEING WORLD WITH FLYING CAMERA

(Continued from page 115)

stereoscopic eyepieces connected to the apparatus, the operator sees the section photographed in relief, with the hills standing out above the valleys. By moving hand wheels and making adjustments with his feet, he guides a floating point in the apparatus to trace the outlines of hills and valleys, starting with a known point of elevation.

These curving contour lines are reproduced on a sheet of paper on an attached table by means of a long, pen-holding mechanical arm. An assistant operator adds data, such as the position of roads and houses. When the work is finished, the sections, which represent the various double negatives, are pieced together to form the complete contour map of the territory that is being photographed from the air.

MAPPING from the air is probably the most important work done by flying cameras. But, for the pilot at least, getting air pictures of news events is the most exciting. During the Bayonne, N. J., oil refinery fire last summer, I had to dive over flames so low I could feel the heat to get the right position for shooting the pictures.

The latest innovation in getting news photos, introduced by a Detroit, Mich., newspaper, is an autogiro with a special windshield protecting the forward cockpit so the photographer can stand up and take pictures while the ship is hovering above the place where a news event is occurring.

One time when luck favored me on a news-photo assignment was when the *Graf Zeppelin* ended its round-the-world flight at Lakehurst, N. J., in August, 1929. Half a dozen planes and camera men were waiting at a field near the naval air station. Nobody knew where the big dirigible was or when it would arrive. While we waited, I discovered that one of the spectators was trying to fix a short-wave radio receiving set he had installed in his automobile.

Radio is one of my hobbies. I have a short-wave set in my basement that I put together myself and have talked with Germany, England, South America, and Australia. So I helped him tinker with his apparatus. Just as we got it going, the *Graf Zeppelin* was broadcasting its position, less than a hundred miles away. With my photographer, I jumped into the plane, hopped off, and beat the other ships to the incoming air liner.

OFTEN, in photographic planes, there is a special door at the side of the fuselage. It is equipped with a sliding glass which the camera man can crank down to the height of his knees when taking "obliques," or photographs shot at a downward angle from the side of the plane. The highest obliques are taken not more than 700 feet from the ground and usually lower.

Instead of having the sun directly behind the camera, as is the practice in taking pictures on the ground, the air photographers usually want it at right angles. Aerial pictures taken with the sun behind the camera are usually flat and lacking in contrasts. When the sun is at right angles, light and shadow stands out in the resulting pictures.

This knowledge enabled Capt. R. A. "Smitty" Smith, the famous Fairchild photographer, to make an important archeological discovery in the Mayan country of Central America. Knowing that these ancient people had constructed great elevated roads, or causeways, through the jungles, he flew over the forests early in the morning, when the rays from the sun were almost parallel with the ground and snapped a picture from the air. When the negative was developed, it showed two intersecting lines, marking the position of these unknown roads. The slightly greater elevation of the trees growing on the ruined causeways cast a thin line of shadow which the camera caught.

Since 1913, Smitty has been snapping aerial pictures. He has worked in the United States, France, England, Canada, Cuba and Central America. His narrowest squeak, he told me, was when the engine on a plane he was photographing from cracked a water jacket 11,000 feet above the Everglades, in Florida. He and his pilot made a safe landing in a dry clearing. But when they climbed out they found their ship had rolled to a stop beside a poisoned water hole surrounded by the bleaching bones of many animals. They stayed there for four days before a rescue party found them.

Whenever I fly with Smitty, he "steers" me by poking his finger in my back. If he wants me to swing to the right, he touches my right shoulder, to the left, my left shoulder, and straight ahead, the middle of my back. When he wants to go down and get a closer shot, he yells in my ear: "Let's go down and look in the windows!"

A NEWS-PHOTO assignment, two years ago, gave me one of the most thrilling night flights I ever made. Convicts at Auburn Prison, N. Y., had rioted and set fire to one wing of the penitentiary. About eight o'clock in the evening, I got orders to fly to Syracuse and pick up a photographer to make pictures of the burning buildings. Mechanics had a Fairchild cabin monoplane warming up on the starting line. It was mid-winter and bitter cold. The weather report indicated that snow was coming in on a biting wind from the sea. I tested the landing lights, looked over the flares, and then hopped off, heading across the upper part of New York for the Hudson River.

It was ten o'clock when I sat down at the Syracuse field and five minutes later we were off again. Ten miles from the prison, we could see the red glare of the flames reflected on the low ceiling of overhanging clouds. I put the ship into a fast vertical bank and circled the prison three times while the camera man got his pictures. Then we streaked away at full speed for Albany.

Before we got there, snow was slithering along the fuselage and packing on the windshield in front of me. I was barely able to see when our wheels touched the Albany airport. By the time we had the plates on a fast train for New York, the blizzard had closed in.

THE uses to which air photos are put are constantly growing in number. In one city, officials consulted an aerial picture in checking up on taxable property. In another, photographs made 2,000 feet in the air during rush hours were studied to see where the greatest traffic tie-ups occurred. Strangest of all is an instance coming from Central America.

Two hundred men were cutting their way through disease infested forests, clearing a path for an oil pipe line. The engineer in charge received an order from the Mexico City headquarters of the oil company: "Cut through the jungle 100 feet to the left." He did and ran into the dry bed of a river. Pictures taken by an aerial photographer, mapping the region, had shown the natural pathway, invisible to the men fighting their way through the jungle below.

The combination of camera and plane has opened up new fields of accomplishment for photography. It has also opened up new realms of adventure for the aviators who pilot the flying camera men.

FIRE AND TOOLS MADE MEN-APES MEN

(Continued from page 36)

slide; they soon found out that it is easier to push a heavy boulder up a gentle slope than up a steep hill. The machine age really started when some savage ancestor of ours, who wanted to move a huge rock from in front of his cave, discovered that he could save himself and his gang untold time and trouble by putting a few round logs under it. This was the origin of the wheel, which has become the heart of our mechanical age. In ancient Assyrian sculptures, you will find a giant winged bull being heaved along with levers and dragged on a sledge with rollers laid underneath; and also a well worked with a pulley. The Egyptians, of course, were well acquainted with pulleys and wheels.

MR. MOK: How old is the wheel as we now know it, and how and where was it developed?

DR. WISSLER: We don't know its age exactly, but it is estimated at from 8,000 to 10,000 years. It began somewhere in Asia, and later spread to Europe. On this continent, there wasn't a single wheel of any description when the Spaniards arrived. The oldest chariot wheels, which already were of an advanced design with four spokes, date from 4,000 B. C. I believe that wheels, in our sense, developed when some old Asiatic had the bright idea of cutting a round log in the shape of a big spool—an axle with two wheels, all in one piece. Crude as it was, you see at once what an advance from a plain roller such a device must have been in carting heavy loads. Curiously enough, the railroads returned to this primitive contraption for the basic design of their wheels. When it occurred to primitive people that it would be much easier, and take fewer hands, to haul heavy burdens if the axle were attached firmly to the load, the separate wheel came into existence, and the cart was a logical development. Naturally the first wheels were solid. Then came a type that was made of separate planks fastened together with wooden pins; later the pieces were dovetailed together and cut to circular shape. Finally, the wheel with a hub, spokes, and an outer rim was invented, when and by whom nobody knows.

MR. MOK: How many spokes were there at first?

DR. WISSLER: Only two, but they were held in place by four braces, the spokes and braces put together in the shape of a letter H with an extended crossbar. Many centuries later, these braces were replaced by a second pair of spokes. That is how the ancients got their four-spoke wheel of 6,000 years ago.

MR. MOK: What kind of tools did they use in those days?

DR. WISSLER: The Egyptians used wedges to split off their huge blocks of stone. You would be surprised if you could see the tools of their carpenters, and even more if you saw those of the carpenters of Greece and Rome.

MR. MOK: Why?

DR. WISSLER: Because they were so much like ours. They had good axes, hammers, saws, and chisels. These tools were made of bronze, an alloy of copper with about one-ninth part tin to harden it; the mixture we now call gunmetal. Fine as they were, their design shows the traces of the much older stone tools that preceded them.

MR. MOK: Did people everywhere begin by using stone tools?

DR. WISSLER: Yes, in all inhabited parts of the world, no matter how civilized, stone tools and weapons have been found in gravel beds, peat-bogs, and other ancient soil formations. Primitive men also used wood, bone, and horn; in fact, anything that he found ready to his hand *(Continued on page 118)*

FIRE AND TOOLS MADE MEN-APES MEN

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in nature. The earliest tools found in western Europe were those of the Chellean Man.

MR. MOK: Who was he?

DR. WISSLER: He was, presumably, the immediate predecessor of the Neanderthal Man, who lived from 20,000 to 100,000 years ago. We call him Chellean because his implements were found near the small town of Chelles, in France; just as the tools of the later Neanderthalers are called Mousterian implements because they were unearthed in the neighborhood of Le Moustier, in France.

MR. MOK: What were these Chellean early tools like?

DR. WISSLER: The Chellean tools are flint hand-axes and other chopping tools, usually chipped into leaf-shaped forms. The remarkable feature is that, while they evidently were designed to be used in the hand, they are much larger than our hands can conveniently grip. The Mousterian implements, which include points, piercers, and scrapers as well as axes and sling-stones, are smaller and more skillfully made. Stone hatchets, scrapers, pounding stones and saws, and bone spear heads, arrow straighteners and other objects of a later period have been found in caves in Central France. Remains of mammoths and reindeer were unearthed together with these implements and weapons.

MR. MOK: Reindeer?

DR. WISSLER: Yes, reindeer were plentiful in France in those days, and these Stone Age Men hunted them as well as mammoths, bison, and cave bears. As a matter of fact, the findings in these caves show that these early Europeans lived much the same sort of life as the Eskimos led until not so long ago, when they still hunted Polar bears with stone spears. Like the Eskimos, they spent their spare time carving figures of animals. Plenty of such carvings survive. There are many reindeer heads, scratched on stone and horn, and one remarkable specimen is a sketch of a mammoth done on a piece of its own ivory. The tremendously long period in which the earliest tools were used, stretching from the early Ice Age men to about 20,000 years ago, is known as the Old Stone Age.

MR. MOK: And the New Stone Age was the next period?

DR. WISSLER: Yes. That was the first age of specialization.

MR. MOK: Why do you call it that?

DR. WISSLER: Because the New Stone Age men developed the idea of making special tools for special jobs. You see, in the beginning, implements were, you might say, Jacks of all trades. The same ax that was used to knock a piece of stone off a rock also served to smash the skull of an enemy or a wild animal. Slowly, tools that first had been made to do several kinds of work in a rough way were varied and changed to suit one particular purpose. We, of course, have become past masters in this art of adapting and refining tools. You and I would be horrified, for example, at the idea of the blacksmith pulling one of our teeth with his pincers; yet our forefathers, not so very long ago, thought nothing of it. The forceps of the modern dentist is a refined adaptation of the blacksmith's tool; a special variety of pincers for a special job.

MR. MOK: You mean that the New Stone Age men originated this art of varying and adapting tools?

DR. WISSLER: You can't say exactly they originated it, for it had always been going on more or less, but they started it in earnest. They invented, for instance, the ax or hammer head with a hole in it for a handle. In this connection, it is interesting to know that our word hammer comes from the old Scandinavian *hamarr*, which means both hammer and rock. They had an endless variety of these ax-heads, and of chisels; hammer-stones, plain and with cuplike depressions; spear and arrow heads; saws; knives; scrapers; bones; gouges; daggers, and many other tools and weapons. But their implements differed from those of the Old Stone Age not only in variety and usefulness; they also were far superior in workmanship. In nearly every case, they were polished and ground to a perfect cutting edge, while the earlier tools and weapons were merely chipped or flaked and unpolished. The New Stone Age men were the first people to use mills and grinding and whet stones. Now, these inventions and improvements and all that came after them would have been impossible; in fact, there never would have been any civilization at all, if it had not been for one thing.

MR. MOK: What was that?

DR. WISSLER: The spirit of coöperation; in other words, team play. If man had worked singly, as an individual, he would have accomplished nothing; in a group there is almost no limit to what he can do. Take, for example, this matter of making tools. If a single man had been permitted to monopolize that art, it would, of course, have been lost when he died. So, very early, people conceived the idea of apprenticeship. When a man was a good tool maker, a bright young lad was apprenticed to him, so that his skill would be preserved to the group.

MR. MOK: Did the New Stone Age men originate that idea?

DR. WISSLER: They developed it to a remarkable degree, but the notion of living and working in groups, in communities in other words, and of coöperating for the good of all, is much older.

MR. MOK: What started it?

DR. WISSLER: Big-game hunting. Our earliest ancestors were hunters and survived only because they killed big game. Bagging huge wild animals with the poor equipment those people had was no easy job. It called for organization and team work by a number of strong, brave, able men. No single family had a sufficient quota of such huntsmen. That is why, together with group hunting, there developed the clan or tribe, a combination of families, all more or less interrelated.

MR. MOK: When did people begin to live in families?

DR. WISSLER: They always have. It is an instinctive human trait, which we seem to have inherited from our apelike ancestors. Most of the big apes run in troops; and any outsider is an enemy or, at least, under suspicion.

MR. MOK: Did the prehistoric family resemble the present-day household? I mean did it consist, in the main, of a father, a mother, and their children?

DR. WISSLER: No, the earliest family was more like an ape-troop; that is to say, rather than a single pair with their offspring there was a group of descendants of one pair. There was the "old man," the boss; several young men and women, and their children, a dozen or fifteen individuals at most. The family, of course, was the basic group; the heart of the tribe. But it was big-game hunting that developed the tribe and the village. It also was responsible for politics and war.

MR. MOK: How is that?

DR. WISSLER: As soon as you have a primitive community, you also get a crude form of government. The "old men" of the various individual families *(Continued on page 119)*

FIRE AND TOOLS MADE MEN-APES MEN

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got together and became the elders of the tribe. By common consent, one of them, usually the smartest and most experienced hunter, was chosen head of the tribe. Here you have your first chief, or king.

MR. MOK: How did big-game hunting develop war?

DR. WISSLER: In this way: Hunting began, of course, as a necessity and later became a sport. It developed man's ambition; it gave him the thrill of the chase, the satisfaction of obstacles overcome, and the joy of subduing strong, huge animals by force and cunning. Thus, he got a sense of power, and a definite fighting technique into the bargain. When you give a picked group of men this kind of special training, you have the beginnings of an army on your hands. Small wonder that, when an argument arose between tribes, it was settled by group fighting. The technique the tribes had acquired in fighting animals, they now used in fighting each other. That was the beginning of organized warfare.

MR. MOK: What did they fight about?

DR. WISSLER: Usually to protect their hunting preserves.

MR. MOK: A while ago, you said that the New Stone Age men were the first people who used mills. Did that mean that they were farmers instead of hunters?

DR. WISSLER: Yes. They had agriculture and domestic animals. But let us talk about those things the next time. Then I will also tell you something about pottery and cooking, the use of metals, and another important item—clothes.

DID you know that the world's first farmers were not men, but women? That people baked bread before they knew how to raise crops? Who were the first tailors? What did our earliest ancestors eat? How did they learn to cook their food? What was the first metal mined? These and other absorbing questions will be answered by Dr. Wissler in the next installment of this series in MAY POPULAR SCIENCE MONTHLY, *on sale April 1.*

STRANGE ICE FORMED IN HUMAN BODY

EVERY normal human body is full of ice, according to Dr. N. Marinesco, French biochemist. But it is in no danger of freezing, since the "ice" is of a different variety from that found in the household refrigerator.

Water forms at least six different kinds of ice, science has discovered, and variety number six is a "warm ice" capable of existing at temperatures between forty and 176 degrees F. It can be formed in the laboratory only under the enormous pressures of more than 100,000 pounds to the square inch, but the forces acting within the microscopic layers of living tissue are believed to be sufficient for its formation.

LAST TWO ELEMENTS NAMED FOR STATES

THE last two chemical elements to be discovered, numbers eighty-seven and eighty-five, have had their formal christening. "Virginium" and "Alabamine" are the names chosen for them by Prof. Fred Allison, Alabama Polytechnic Institute physicist under whose direction they were found. Their discovery in 1930 and 1931, completing the roll of chemical elements, leave no more to be discovered.

The name "Virginium" honors the state of Virginia, where Prof. Allison received his scientific training. "Alabamine" is named for the state of his adoption, and where he is at present carrying on his researches.

A definite program for getting ahead financially will be found on page four of this issue

FIGHTING CROOKS IN A PORT

(Continued from page 53)

all over the world are riding high and empty, and what the crews do to kill time keeps the police busy. Recently Sergeant Benson and three of his men, after a swift dash in the *Sinco*, climbed up the high rusty side of a Scandinavian tramp steamer. They stepped to the deck with a Thompson submachine gun ready for action. The whole crew, all drunk, were fighting among themselves in a manner that would have delighted a Hollywood director. The sight of the bluecoats and the submachine gun swiftly sobered them.

More recently river pirates boarded the docked freighter *West Lashaway*, bound Captain Huntley, the master, in his bunk, looted the cabin, and escaped in a small boat. Nothing like that, Captain Huntley will testify, ever happened to him along the West Coast of Africa where most of his voyages take him; yet the police have been amazingly successful in repressing harbor pirates.

THERE is still plenty of thieving, but most of it occurs on the docks. Formerly fleets of junk boats cruising in the harbor were manned chiefly by criminals. It was their practice to "bleed" cargoes on lighter barges. Coffee, crude rubber, ingots of metal, rope, manufactured goods—anything was loot to them and often they had the coöperation of barge captains.

In 1912 these thieves stole a quarter of a million dollars worth of coal. Four years later, so well had the harbor police done their work that not a single complaint was made against coal thieves.

New York's salt water cops have their busiest times when there is a fire in the harbor. At such times the two municipal navies work together. It is significant of the character of the men in these branches of the police and fire departments that Mulrooney, present police commissioner, and John Kenlon, who lately retired as fire chief, prepared themselves for their high commands by service in the boats.

If the services seem equal in the quality of their men, the fire department is undeniably superior in the quality of its boats. This is necessarily so, for a fire boat is an intricate and costly mechanism. Acting Deputy Chief Leonard Gebhard, who commands the marine division of the fire department's ten fire fighting boats and 200 men, only lately received the newest and finest of all fire boats, the *John Harvey*.

THIS twin-screw steel craft is an innovation. She is powered by five gasoline engines with a total of 2,740 horsepower; heretofore all fire boats have been operated by steam. The four pumps of the new boat can throw 16,000 gallons of water a minute, sufficient to fill 800 bathtubs. Her fuel supply is carried in two gasoline tanks with a capacity of 2,000 gallons each. Ingenious contrivances have been devised to protect this dangerous cargo. As gasoline is consumed water replaces it, so that at no time is there space for the formation of explosive vapors. Besides, the engine room and the gasoline tanks are protected by batteries of automatic extinguishers containing carbon dioxide.

In addition lines of perforated pipes make it possible for the fire boat to be curtained with jets of water whenever it is dangerously close to a fire. In cold weather the old-fashioned fire boats often are hampered by the formation on their decks of great mounds of ice. In the new boat, the exhaust is used to heat the decks so ice cannot form on them.

Besides three floodlights, each capable of illuminating an area of fifty feet as brilliantly as day, the *John Harvey* carries a searchlight of 1,500,000 candlepower. But her pumps are the pride of the fire department.

On deck there are eight big brass water guns that justify the reference to this craft as a battleship. In a recent test these guns threw water over the George Washington Memorial Bridge as the boat passed beneath on the surface of the Hudson River. In addition it carries three quarters of a mile of fire hose, for these boats assist the land apparatus at all big fires within three blocks of the water front.

The *John Harvey* is a grim reminder of the special hazards attaching to the work of the marine division of the fire department. John Harvey was pilot of the fire boat *Thomas Willard*.

In 1930, while the Hamburg-American liner *Muenchen* was at sea steaming toward New York with a rich cargo and a large company of passengers, she was discovered to be afire. No hint of this grave condition was allowed to reach the passengers. The ship docked at Pier 42 and the last passenger was ashore before the river was filled with the echoes of the screaming sirens of the fire boats, rushing to the aid of the burning ship.

HER decks were beginning to bulge upward from the pressure of imprisoned gases when the *Thomas Willard* steamed alongside, and smoke and flame were beginning to billow from the vast liner. There were targets now for the water guns of the fire boat fleet and tons of water were hurled into the heart of the fire. The *Thomas Willard* was throwing geysers of water into the flames from a position near the boilers of the liner. When these exploded that portion of the river in which the fire boat floated was literally blown from under her. Afterward her crew testified that she seemed to touch bottom before the backward rush of water hurled her again to the surface. How any of them escaped is still a matter for wonder in the department; but as they resumed the fight against the fire a check showed that only one man was missing: John Harvey, the pilot.

The pilot of the *John Harvey*, Alfred Smith, holds a full branch ticket that qualifies him to take any vessel afloat into or out of New York harbor.

THE big advantage of the fire boats is that they commonly have under their keels plenty of water and in their mechanisms the means to get that water and throw it onto a fire. But sometimes they get into situations where their crews would be happier to have more water under their keels.

Chief Gebhard, admiral of this extraordinary fleet, remembers one such incident.

In 1917 the Chief was aboard the fire boat *William J. Gaynor* as she steamed down the Narrows to a dock at Fort Hamilton where a bargelike craft was on fire. The *Gaynor* steamed alongside and began to squirt streams of water on the fire. The boat was loaded with munitions, cartridges, and small shells. Suddenly the *Gaynor's* crew were in the midst of a series of explosions; shells popped out of the burning ship, and the racket of exploding bullets was deafening. But through it all the *Gaynor* stood by and pumped water into the flames.

The officer in command of the Fort was enthusiastic in his praise of the men of the fire boat.

"We took that praise in modest silence," said Chief Gebhard recently. "After all, we'd have been less than human if we had revealed that our boat had run aground when we went alongside the munitions boat. We stayed because we had to; we did not get off until the tide lifted us."

MAN-MADE WEATHER

(Continued from page 55)

plants were next to recognize the boon of a climate that could be made to order. Fluctuations of indoor temperature and humidity had always been their worry. Changes in humidity produced every sort of deformity of paper—wavy edges, buckling, curling, creasing, stretching, and shrinking. It caused roller troubles and variations in ink.

Weather manufactured by the same type of equipment as was used in the textile mills, but adjusted for a lower and more humanly comfortable temperature and relative humidity, completely eliminated these printing troubles.

Its value established, air-conditioning apparatus rapidly made its way into an ever-widening circle of industries. Wood furniture and other wood products, sanitary ware, brick, tile, pottery, insulators, abrasives, confectionery, medical products such as coated pills, effervescent salts, capsules, and all kinds of standardized prescriptions; still and motion picture film, lacquer and varnish, leather and leather goods, paper and paper products, artificial pearls, rubber, soap, food products, including bread—all these products, besides others which number in hundreds, are today made under conditions which make manufactured weather almost indispensable.

A NUMBER of industries, including the rayon and machine-made cigar industries, owe their very existence to this weather. In the making of rayon, that silklike material conjured from spruce trees by chemists' magic, temperature and humidity must be controlled precisely through every stage of the process. Into the three great plants of the Viscose Company, makers of seventy-five percent of all the rayon used in the United States, manufactured air is poured at the rate of 5,000,000 cubic feet a minute!

The weather requirements imposed by industry run the whole range of weather variations met in experience, besides many that must be invented for the occasion.

That every drop of moisture may be blotted from the paper insulation, telephone toll cables are made in a manufactured atmosphere maintained at temperatures above a hundred degrees Fahrenheit and extremely low relative humidity. Bread is raised in air that is warm and moist. The atmosphere required for many of the stages of candy making is cold and moderately dry.

Medical capsule making demands an astonishing regulation of climate. Dust must of course be absent; temperature must be constant within a few degrees; greatest of all, however, the humidity must not vary more than one quarter of a grain (1/28,000 of a pound!) per cubic foot! A variation greater than this might change the viscosity of the gelatin sufficiently seriously to influence the production and quality.

IN EGG storage houses, humidity is exceedingly important. If the relative humidity is too high molds and mildews develop, causing the eggs to become musty and have an unpleasant taste. If too low, moisture is robbed from the eggs, causing them to shrink and "rattle."

Conditions of climate other than timely or local have long been produced in greenhouses for raising crops out of season or nurturing plants foreign to the territory. Several colleges and scientific institutions, including the University of California, the University of Chicago, and the Boyce Thompson Institute for Plant Research, Yonkers, N. Y., have lately installed special compartments in which the temperature and humidity may be regulated to produce any combination of climatic conditions encountered from the equator to the poles! *(Continued on page 122)*

MAN-MADE WEATHER

(Continued from page 121)

Tropical climate, faithfully reproduced by air-conditioning apparatus, enables "schedule ripening" of South and Central American fruits in northern storage houses. The fruits are picked when green, shipped north under cold storage, and ripened as needed by controlled weather.

In certain industrial operations the highest degree of comfort, as far as the weather is concerned, must be sacrificed to some special demand of the work. However, this is not always true, and some of the first uses of manufactured weather were for the health and comfort of workers.

The first nonindustrial installation of importance was that of the New York Stock Exchange, engineered in 1902 by Werner Nygren. The new-fangled idea of humidifying as well as heating in winter, and cooling in summer, was sold with difficulty to a skeptical building committee.

Early air-conditioning systems for summer use depended for cooling, in most instances, upon water sprays. The invention, about nine years ago, of a safe, efficient, compact, and automatic refrigerating unit revolutionized weather-making science.

Cooling and dehumidifying systems were in a few years installed in the great movie theaters. Almost immediately the "summer slump" was turned into a bonanza. Auditoriums, department stores, restaurants, banks, followed suit. Not only did the new weather attract customers, but it increased the health and efficiency of workers. In offices, by requiring that all windows be kept shut, the use of conditioned air eliminated the distracting effect of noise.

In 1928 and 1929 manufactured weather was introduced in the Senate Chamber and the Representatives' Hall of the Capitol at Washington, D. C., to cool the nation's representatives in summer and to keep them from drying up in winter.

It may be interesting to note here that the dense water sprays which in an air-conditioning system wash and humidify the air in winter also, with the aid of refrigeration, *dehumidify* the air in summer, thus adding a quality of comfort that mere cooling could never give. When moisture is to be taken from the air the water sprays are cooled below what is known as the "dew point." At that point moisture is precipitated from the air like rain from a cloud that has been cooled.

In the new Philadelphia Saving Fund Society's building it is estimated that the air-conditioning apparatus, with a cooling capacity equivalent to nearly 1,000 tons of ice melting in twenty-four hours, may extract more than 8,000 gallons of water from the air distributed during a single humid twelve-hour day!

The broadcasting studio and the "talkie" studio had naturally to be equipped with a conditioned air supply. The latter, constructed often of concrete and gypsum blocks, lined with some sound-deadening substance and entered by means of an outer and inner door, is often as well insulated and as air-tight as an ordinary refrigerator. All the air that the occupants breathe must be forced in and out at a rate sufficient for health, yet noiselessly and without any abnormal draft.

In the Harlem Hospital and the Rockefeller Institute, New York City, and the University of Maryland Hospital, to mention a few of the pioneers, oxygen chambers, which allow independent control over temperature, humidity, and carbon dioxide content of the air circulated—besides the possibility of supplying additional oxygen—have been successfully used in the treatment of pneumonia cases. A number of air-conditioned rooms are also in use for the nurture of premature babies.

The new home office of the Metropolitan Life Insurance Company, rising now in New York City, will be the largest office building in the world to be completely supplied with manufactured weather.

Tested thoroughly in industry and in public buildings, plants for weather-making are now available for the home. The cost of the necessary equipment is from a third to a half more than the cost of a good two-pipe steam heating plant. Although perhaps less spectacular, the maintenance of a scientifically correct relative humidity in winter is at least as important as summer cooling.

The latter, plus dehumidification, is a problem that may soon be solved. Compared to the average food refrigerator, the amount of refrigeration required to cool an ordinary eight-room house is amazing. The food refrigerator produces a cooling effect equal to that produced by the melting of one-tenth of a ton of ice a day. Refrigeration equaling the effect of six to ten tons—or from sixty to one hundred times as much—would be necessary to cool the house! However, the cost of operation of the larger plant would be proportionately less.

It has been estimated that the young science of manufacturing weather is already saving industry about $15,000,000 in cold cash every year. Who dares to predict what it will contribute in the next few years—when it finds extensive use in offices and homes—to the intangible values of comfort and health!

LANGMUIR WINS OUR $10,000 AWARD

(Continued from page 27)

cash, it saves the American public more than a million dollars a night on its billion-a-year electric light bill.

The gas-filled lamp is only one of several practical results of Dr. Langmuir's extensive researches. He has carried out successful work on the vacuum lamp and on radio tubes. His long study of atomic hydrogen led him to the atomic hydrogen flame, the use of which in welding is expanding rapidly.

Before Dr. Langmuir became associated with the General Electric Laboratories more than twenty years ago, electrical experts, from Edison down, had tried to improve the vacuum of the incandescent lamp. In his vacuum studies, Langmuir exhausted empty lamp bulbs and bulbs containing filaments at all possible temperatures. For days he operated lamps under liquid air, and he devised a method of exhausting lamp bulbs heated close to their melting point.

With his co-workers, he literally spent years doing such work. They conducted extensive experiments in which the slightest traces of various gases were put into the most perfectly evacuated bulbs, and their reactions, absorptions, and distributions were studied. This work has never really stopped, and the original apparatus, still in use, may be destined to contribute further to the science of atomic and electronic physics.

Langmuir's discovery of the atomic welding arc, in 1927, also was a product of gradual growth and patient, persistent research. By means of this remarkable device, hitherto unweldable metals can be melted and fused without a trace of oxidation, and in some cases welding can *(Continued on page 123)*

LANGMUIR WINS OUR $10,000 AWARD

(Continued from page 122)

be performed on paper-thin metal sheets.

The secret of the process lies in the passage of a stream of hydrogen through the arc between two electrodes. The heat of the arc breaks the hydrogen molecules up into atoms. These atoms recombine a short distance beyond the arc into molecules of the gas, and this process liberates an enormous amount of heat, so that more effective temperatures can be obtained than with ordinary welding methods.

For fifteen years prior to this invention, Langmuir experimented with incandescent filaments in hydrogen gas. In the course of these studies, he discovered evidence indicating the splitting of hydrogen atoms, a process that absorbed a tremendous amount of heat. His conclusion that their recombination would liberate an equally great amount of heat led him to his invention.

WHILE conducting these and other researches, he published articles on the dissociation, or splitting, of hydrogen in 1911, 1912, 1914, 1915, and 1916. The atomic-hydrogen arc welding process was completed in 1926, and perfected for practical use a year later.

Aside from the distinguished service Dr. Langmuir has rendered the electrical industry and, through it, a vast majority of the American people, leading authorities rate his published scientific work as his most valuable contribution, for the reason that they consider it a firm basis upon which he and others will continue to build.

During the last twenty years, his published researches on fundamental physical and chemical subjects have averaged seven each year, all of them original work. They cover such widely different fields as chemical reactions at low pressures; conduction, convection, and radiation of heat; vapor pressures of metals; new vacuum pumps and vacuum gages; crystal and atomic structure; electronic and ionic currents; high-power vacuum tubes; and theories of absorption and evaporation.

Born in Brooklyn, N. Y., in 1881, Langmuir was graduated from the School of Mines of Columbia University in 1903. He continued his studies at the University of Goettingen, in Germany, where he received his Master's degree and his Doctorate of Philosophy. Returning to this country, he served the Stevens Institute of Technology, Hoboken, N. J., as instructor of chemistry from 1906 to 1909, after which he became connected with the research laboratories of the General Electric Company.

Dr. Langmuir has been the recipient of a number of honorary degrees and other distinctions. Northwestern University conferred upon him the degree of Doctor of Science in 1921, and in the same year Edinburgh University, Scotland, conferred the honorary degree of Doctor of Laws. He received the degree of Doctor of Science from Union University, Jackson, Tenn., in 1923, from Columbia University in 1925, and from Kenyon College, Gambier, O., in 1927.

Twice Dr. Langmuir was awarded the Nichols Medal by the New York Section of the American Chemical Society; in 1915 for his work on chemical reactions at low pressures, and in 1920 for work on atomic structure. In 1918, the Royal Society of London bestowed upon him the Hughes Medal for his researches in molecular physics; and the American Academy of Arts and Sciences, in 1920, awarded him its Rumford Medal for his thermionic researches and his gas-filled lamp. In 1925, he was the recipient of the Cannizaro Prize from the Royal Academy of Lincei, in Rome, Italy, and in 1928 of the Perkin Medal.

RADIUM STRIKE IN CANADIAN WILDS

(Continued from page 19)

On the lonely beach we raised our tents, a seven-by-seven silk one and a seven-by-nine duck tent; and I built a cache on log stilts to protect our food supply from bears and wolverenes. That night, after supper, I began my work with a visit to the camp of Gilbert LaBine, who first found a vein of pitchblende in the region in 1930.

The recovery of radium from pitchblende is a complicated process involving treatment with hot acids, and vast quantities of material have to be handled in order to produce a tiny bit of radium. Yet this ore justified the cost of shipment from that remote spot. A lot of weird things have been said about this ore; yet the truth is startling enough.

According to a conservative report of an expert of the Department of Mines who was sent in from Ottawa, the two veins of the original find may yield at least several thousand tons of high grade pitchblende. But we now know there are many mineralized veins up there, and this is one of the reasons why this spring will see swarms of prospectors, mining engineers, and geologists flying into the North. I want to be ahead of them. I expect to fly up there some time during the month of February, weeks before this narrative is printed.

I SHALL take with me a supply of dynamite to explore intensively the two areas I staked last fall and afterward recorded. Roughly speaking, there are four kinds of prospecting. LaBine, when he flew across that uninhabited region, was engaged in the first kind. He was watching the terrain that passed beneath him for signs of mineralization that often reveal themselves by gossans, richly colored areas of mineralized rock. Copper and other metallic outcrops are oxidized by weather, and in that thin-soiled country Nature's unclaimed stores of mineral deposits are advertised to the trained eyes of flying prospectors by the coloring of the earth's surface.

The second stage is that in which they were engaged when they came to earth and began to hunt for the veins from which those stains had come; the same stage of the work in which I engaged last fall. The third stage, intensive prospecting, is usually accomplished by cutting intersecting trenches across a series of claims in order to establish the veins of ore. The final stage comes when shafts are sunk or diamond drilling machines are set up on a lucky prospector's claims.

Cylindrical drills faced with black diamonds are cut into the earth and the cores which these bring up enable mining engineers to estimate, with reasonable accuracy, the value of the ore that lies beneath the surface. Such operations cost a lot of money, and vastly more must be spent before mining machinery is set up for the production and treatment of ore.

NEVERTHELESS, it is highly possible, I think, that some mines will be developed in that country from the money received for hand cobbed pitchblende ore; to cob ore means to break it down with a hammer and sort out the richly mineralized fragments for treatment. Those twenty tons of pitchblende which have been shipped out are expected to yield a total of no more than two and a half grams of radium; but with radium worth $50,000 a gram, this means that the selected ore may have a value of as much as $5,000 a ton.

The ore was carried to the railroad's end at Waterways by a succession of journeys in scows and small boats at a cost said to have been about $400 a ton. At $5,000 a ton it is easily worth the cost of shipping.

One man who made a flying visit to the fields last year came out to civilization and made the astounding statement that he had been burned by sitting, unaware, on a sack in the plane that contained samples of pitchblende ore! Either he had a rich imagination or an ultra-sensitive skin.

The fact is that pitchblende contains uranium oxide, and radium is formed by the decay, through countless years, of uranium. No one need hope to find radium in visible masses, because after taking eons of time to form, the radium itself rapidly decays further until it turns into other metallic elements. Certainly there is no believable record of anyone ever having been burned by handling radioactive ore.

The black color and great weight of pitchblende is, in general, satisfactory evidence of the presence of radium. However, there is an instrument for a positive test for radium-bearing ore which can be used in the field. The instrument can be bought or made at home for a cost of two or three dollars. It is called a spinthariscope. With this, several hundred ore samples can be tested in one evening. The spinthariscope is a tube whose length is about one fiftieth of an inch longer than the focal length of an ordinary magnifying lens fitted at the upper end. The lower end of the tube is fitted with a glass disk. This is coated with any transparent gummy substance, such as a drop of a solution of gum arabic, in order to hold to the glass a film of particles of zinc sulphide. Simple enough; but it works.

ZINC sulphide is a fine, yellow crystalline powder that will glow after being exposed to sunlight; consequently, to serve a prospector's purpose it must be kept in the dark as carefully as one would protect unexposed camera film. When a spinthariscope is focused in the dark over a sample of radium-bearing ore the sensitive zinc sulphide seems to blaze with a cold fire.

Whenever a prospector in the darkness of his cabin sees a scintillating glow down the barrel of his spinthariscope, he knows the ore he holds in his hand is radioactive. Last year, so far as I know, none of the thirty-odd prospectors who got to Great Bear Lake had such an instrument; this year I suspect there will be many of them.

In hunting for the ground I staked last fall, I ranged a region of about twenty-five miles square. I had to travel in a canoe or walk, and when I walked I had to carry a pack weighing from 100 to 125 pounds. It was a region of steep hills, and if I made a mile and a half an hour I was doing well, for I never failed to keep my eyes alert for signs of raw treasure.

FOR such nights as I slept away from our cabin, I carried an eider-down sleeping bag. But I found that the moisture of my body accumulated in that arrangement too fast for comfort; by October I frequently fastened myself into a bag stiff with ice. This year I shall have a bag made of caribou skins, hair side in. Always I carried a revolver and sometimes my thirty-thirty.

Five days after I reached Great Bear Lake I awoke in a snowstorm. That was September 17; yet by noon the day had turned fine and warm. I saw two robins, acres of wild flowers, and feasted on wild raspberries. It is a strange country.

There are no deer; but there is plenty of other wild life. One morning I discovered the tracks of a big grizzly who had been snuffling around our cabin as we slept. A hundred miles away, on Coronation Gulf, are the Coppermine Eskimos who, centuries ago, were using knives, spears, *(Continued on page 125)*

RADIUM STRIKE IN CANADIAN WILDS

(Continued from page 124)

and other utensils fashioned of copper! For nearly 200 years explorers and traders have been commenting on this fact; yet only now, thanks to the airplane, are white men preparing to bring these stores of natural riches to the uses of civilization.

In the meantime the Eskimos themselves have adopted high-power rifles, gasoline power boats, and all manner of white man's appliances to their own use. Some, I am told, have radios; not in igloos, to be sure, for many of them live in good houses on the shore of Coronation Gulf.

In a few years any tourist will be able to fly up there, where he may see the northern lights bright in fantastic shapes, wavy circles, bands, and streamers washed through with rainbow colors as I saw them last fall.

On a lonely barren up there, I chipped off samples of rock from a vein of quartz that seemed to me to spell fortune. This was late in November. Early in December, with a toboggan made of birch poles, three of us started for LaBine Point to await the planes, leaving one man to spend the winter in the cabin.

IT WAS forty degrees below zero when we started off and our faces, where they protruded from the parka hoods, were purple with cold. No longer was the sun a disk that moved around the horizon during a twenty-four-hour day; instead, it never appeared above the horizon, and daylight was a brief blur of twilight lasting only an hour or so under the overcast sky.

One of the planes that arrived December 8 brought me $2,000 to pay for the ride out of the wilderness.

Starting an airplane engine in below-zero temperatures is a job. Immediately after landing, the pilots drained the oil from the air-cooled engines. When it was time to go they placed this congealed oil in large tins over a fire to "cook." Then each fixed a small, tentlike hood over his engine and placed a couple of blowtorches within these shelters.

By the time the oil was almost at the boiling point the metal of the engines was burning hot to the touch. Quickly the scalding oil was poured into the crank cases, and then, for seconds count, in great haste the propellers were turned over and the engines began to roar.

Flying southward was like coming out of a funnel of time; for each hour we sped along above the clouds we were gaining minutes of daylight. Even so, when we landed at Rae at one o'clock after an hour and a half of flying, darkness was already falling over the settlement. At Ft. Smith I spent two days recording our claims and then took off for Edmonton, the train, and home.

"FIZZ GAS" ONCE FORMED EARTH'S ATMOSPHERE

THE earth's life-sustaining blanket of oxygen gas is a comparatively new acquisition, as geologists measure time. So declares Prof. Alfred C. Lane, of Tufts College, who holds that carbon dioxide, familiar as the "fizz" in soda water once constituted a large part of our atmosphere. This gas and water vapor are the commonest in outpourings from volcanoes, which probably supplied the first "air." The change to its present form must have occurred several hundred million years ago as a result of the turning of carbon dioxide to limestone and other compounds, and the liberation of oxygen as a by-product during the formation of substances such as petroleum and coal.

A definite program for getting ahead financially will be found on page four of this issue

CLEANLINESS PAYS ON MOTOR CAR

(Continued from page 74)

washing. Most fellows, after they get through washing off the mud and grime with soap and water, just let the car stand till it's dry. If you could rinse the car with distilled water, that would be fine, but any ordinary water contains chemicals, and every drop leaves a spot when it dries.

"The proper trick is to wipe off all the water drops with a piece of chamois leather. What's still more important is to see that the chamois is clean. Unless you frequently wash the chamois with soap and water, it'll pick up grit and scratch the finish."

"Seems to me," Joe grinned, "most fellows don't want to go to all that bother."

"Humph!" Gus grunted. "I'm a bachelor, and nobody cares whether I keep my car clean or not, but I should think you married birds would take the trouble to keep your cars clean just to keep your wives from jawing.

"After traveling through rain and mud, suppose you let the hose flow on your car gently to flush off the loose, wet mud, and then give a quick wipe with the chamois. Isn't that better than letting it dry and cake on so you have to give the car a regular wash?"

"It would be less work in the end, I suppose," Joe agreed, "once you got the habit."

Joe glanced toward the corner of the garage where the veteran auto mechanic's own car stood in its accustomed place.

"Yes," he nodded as he observed with renewed interest the spotless condition of Gus's two-year-old bus, "I think I'll treat my boat to a thorough cleaning and then try to follow your method."

Gus walked over to his car and lifted the hood. "Take a squint at that," he suggested as he swung a drop light around so that its light fell on the motor.

"Gosh!" Joe exclaimed as he gazed at the motor, which looked as though it had been dolled up for an exhibition chassis. "You could eat your dinner off any part of that motor. What's the use of keeping the motor so clean when nobody sees it anyhow?"

"I wouldn't argue that point with you," Gus smiled. "But there are mechanical reasons why it's a good idea to keep the motor clean. In the first place a clean motor is easy to work on. Even so simple a thing as changing a spark plug is a filthy, disagreeable job if the motor is covered with road dust and oil. Also, it's a lot easier to see what you're doing on a clean motor. On top of that, a clean motor runs better because when you clean the motor, you just naturally clean the distributor head and the spark plug cables. Then, if you get caught in a driving rain, all their juice won't flow out through the damp muck that coats them."

"What's the easiest way to clean a motor?"

"If you haven't air pressure as we have here, the best way is to fill a gasoline torch with kerosene and just chase the dirt off the motor with a fine stream of the liquid."

"Funny I never heard you suggest cleaning a motor to any customer," said Joe.

Gus laughed. "Sure I do," he protested. "If I think a fellow has gumption enough to appreciate the value of taking good care of a fine piece of machinery like an auto motor, I get him started right. Of course when I run into the kind of bird who only has the front of his house painted because the back doesn't show, it'd be a waste of time!"

TOMB OF MEXICAN "KING TUT"

(Continued from page 25)

The palaces and temples that once topped the pyramids have fallen into ruin, but a number of columns carved with human and animal figures and hieroglyphics still stand. In some of the pyramids, or mounds, are narrow vaulted chambers, and excavations have bared the ground plans of several buildings. The Mexican government has begun the restoration of one of the platforms, known as "The Platform of the North."

Where did the Zapotecs and Mixtecs get the precious metals and stones for the splendid ornaments and pieces of jewelry such as those found by Caso? By far the greater part of the gold supply came from Costa Rica and Colombia, though some was mined in southern and western Mexico.

Jade, found in eastern Mexico and Guatemala, was worked into ornaments in ancient times, but turquoise is rarely found in the oldest ruins. The Toltecs obtained it from far-away New Mexico, sending parrots and copper bells to the Pueblo Indians in exchange. Emeralds were secured from the famous Muzo mines in Colombia, and pearls appear to have been imported from the Pacific coast of Central America. Pearls of large size, as well as emeralds, were included in the loot sent to Spain by Cortez.

Several mysterious features, indicating Mayan influence, were found at Monte Alban, such as pointed arches in typically Mayan style. In the fifth tomb entered by the Caso party, a flat, distinctly Mayan skull was encountered.

According to Caso, the superb workmanship of the treasures from the seventh tomb shows a highly advanced stage of civilization. The filigree work is of the finest, some of the edges having been worked to paper thinness. One death mask, in Caso's opinion, is one of the most beautiful gold-engraved objects in the world. It is plastered with gold and studded with turquoise.

Another sacred mask, representing the god Xipetotec, is one of the barbaric prizes of the collection. Xipetotec was the god in whose honor a woman was beheaded and the skin of her body worn as a dress by a dancer in weird religious rituals.

Important though Caso's discoveries are conceded to be by authorities on Central American civilization and history, they merely scratch the surface of the untold wealth that still lies buried at Monte Alban. Not quite two percent of Monte Alban has been excavated thus far, and archeologists believe the scientific and intrinsic value of the material that remains to be uncovered is enormous.

Further exploration next autumn may bring some of this additional riches to light. Then, too, a curious theory recently advanced by Professor Ramon C. Robles, a pure Mixtec Indian, who is federal inspector of schools for the State of Oaxaca, may be tested. According to Robles, ancient tunnels undermine much of the western half of the State of Oaxaca. Old Mixtec hieroglyphics, he announced, tell of such tunnels connecting all the principal Mixtec cities and fortresses with the capital and the royal city of Tilantongo. The longest of these tunnels, if Robles has read his hieroglyphics aright, stretches underground for thirty miles!

The ancient Mixtecs, Robles explained, built the tunnels for protection and quick communication by warriors between the principal strongholds, and one or two of them have been explored in the past. The others have caved in during various earthquakes, which also were responsible for much of the destruction of the temple city of Monte Alban.

SHORT WAVE SET FOR AMATEURS

(Continued from page 73)

The front panel should be a sheet of aluminum, or it can be of wood or any composition covered on the back with sheet copper or aluminum. No soldered connections are made to it.

Before you start the wiring, carefully study the picture wiring diagram of Fig. 4 and the theoretical diagram of Fig. 3 and make sure you understand exactly where each connection is to be made. Also be sure to check each wire on the diagram as you solder it in place and double-check the whole job after you have finished before you attempt to use the set.

Note that the power connections are made to the set by means of a regular Y-type socket at *S4* and a multiple cord connector. If desired, this feature may be eliminated and conventional binding posts substituted. A special cable connector that plugs into the socket can be purchased or you can make one out of the base of any discarded five-prong tube.

AFTER you have the wiring completed and carefully checked, place type 236 tubes in sockets *S1* and *S2* and a type 238 in socket *S3*. Then make connection to the A battery alone and turn on filament switch *W*. Wait a minute and note whether the heaters in the tubes are glowing with a dull red. Now plug the headphones into jack *J* and connect on the B batteries. Three 45-volt blocks are required, and the medium large size will do nicely.

Regeneration in this circuit is controlled by varying the B voltage applied to the screen grid of the detector tube in socket *S2*. Changing the voltage is accomplished by turning the knob at the lower center position of the panel. This knob operates the high resistance potentiometer, *R5*.

Getting the set adjusted to obtain the proper band spread on the amateur frequencies requires care. As you tune condenser *G1* with the regeneration control well on, you will hear chirps and whistlings at many points on the dial.

Assuming that you want to find the proper setting for the 40-meter band, for example, you must tune till you can locate and identify some commercial station on a wave just outside the band on a slightly higher frequency with coil B in place. Condenser *G2* should be set at about five degrees while this tuning is being done. Carefully note the position of condenser *G1* and write it down for future reference, because when set at that point with the 40-meter band coil in place, the whole amateur band can be covered simply by tuning condenser *G2*. Follow the same procedure for coils *A* and *C*. Of course, if you can find some local amateur, you can find out from him to which frequencies his transmitter is tuned and use his signals as calibration. The Arlington time signals also are sent out on short wave frequencies which can be used for checking.

CORNELL STUDENT TURNS HONEY INTO CRYSTALS

How to turn nature's honey into a non-sticky form that can be cut like hard butter and that keeps indefinitely in cans or glass jars is the discovery of a young Cornell University student of agriculture. Of its own accord, honey after months or years will become a mass of gray-white crystals. The experimenter, E. J. Dyce, found honey could be thus transformed by adding a few of the crystals and keeping the mass at the proper temperature for forty-eight hours.

Blackmailers Betrayed By Their Pens

(Continued from page 42)

A microscopic examination of the signature on the "shirt will," he declared, showed that both dots over the "i's" in the "Zimmerli" were made in a peculiar manner. Each had been made with two strokes of the pen, so they resembled a contracted "V" under the lens. Precision measurements further revealed that these spear-shaped dots were both made at exactly the same angle. A study of 150 real Zimmerli signatures showed that although the dots on the "i's" were triangular, he never dotted an "i" with two pen strokes and never made both dots at the same angle. On the strength of this scientific testimony, the "shirt will" was declared a forgery.

To demonstrate such microscopic bits of evidence, enlarged photo-micrographs are usually handed the jury. Sometimes, an expert will throw his pictorial clues, highly magnified, upon a courtroom screen, by means of a projector, while he explains their significance to the jurymen. Enlarged pictures of this sort show which line was made last when two strokes cross. By proving that the tail of the "p" in "Joseph Farrell" was written *over* part of the signature of a witness on a will, J. Clark Sellers, Los Angeles handwriting expert, recently proved the document was a forgery. The discovery disproved testimony in court that the deceased, Farrell, had signed the will before the witnesses placed their signatures on the document.

Another dramatic phase in tracking down forgers is the study of the color and chemical composition of inks and paper. The latest laboratory machine for analyzing such colors is the twenty-seven-wave-length spectrophotometer. In this extraordinary apparatus, two 400-watt lamps are placed within a black metal ball that is kept cool by high-speed action of a suction pump. The device can detect fine variations in color on the basis of differences in wave length.

The approximate age of writing can be ascertained by applying chemical reagents to the ink, and frequently the exact brand of the writing fluid employed can be determined. At the Scientific Crime Detection Laboratory, in Chicago, I was told of an amazing bit of work accomplished by C. Ainsworth Mitchell, the famous English detective, through such chemical tests.

When the will of a British land-owner was probated, it was noticed that the color of the writing seemed different in different parts of the document. Suspecting that the paper had been tampered with, the court submitted it to Mitchell's laboratory for examination.

THROUGH colorimetric tests, this scientific sleuth found three separate inks were used in the writing. Applying chemical reagents, he identified them as particular brands. Then, he bought the three kinds of writing fluid at a stationery shop, mixed them together in one container, and began writing rapidly on a sheet of foolscap. He discovered that the color of the words he wrote *depended upon the depth to which he dipped the pen!*

Having different specific gravities, the three inks occupied different levels in the bottle, the heaviest sinking to the bottom and the lightest remaining on top. Later, it was found that the testator had bought three bottles of ink and had poured them all together when he reached home. This solution of the mystery of the varicolored will gave the rightful heirs a clear title to their inheritance.

The date at which different writing innovations were introduced is always kept in mind by the expert. If a document dated 1800 shows fibers disturbed by the point of a steel pen, it automatically brands itself a fake, because the first steel pen was not used until 1803. Quill pens, employed before that, slid over the sheet without digging in. Wood-pulp paper did not make its appearance until 1860, so documents on such material, dated before that time, are always the work of forgers.

Frequently, the date on which the printed form of a will or business document came from the presses is vital in tracing down a forgery. One of the most spectacular feats of this kind was Osborn's work in the celebrated "Tail of a Comma Case," in 1926.

At the top of printed will forms, code letters indicate the date at which they were run from the presses. In 1924, at White Plains, N. Y., a will was filed for probate with the top of the form cut completely away. Extending below the line where the scissors had cut, Osborn found a tiny black, clawlike mark—the tail of a comma. It had separated words in the printing that had been thrown away. With the precision instruments of his laboratory, he measured its position in relation to letters in the printed form below and compared these measurements with those on the two forms printed by the concern that had produced the form under examination. This test showed that the document was spurious because it was made out on a form which had not been printed *until thirty-four days after the will was supposed to have been signed!*

If a vote were taken among handwriting sleuths as to the most valuable recent aid to their work, the ultra-violet ray would stand at the top of the list. Already, these queer, invisible vibrations of the ether have become ace assistants in forgery hunting. They bring out writing that has been chemically erased, they indicate the age of paper kept under different storage conditions, and they reveal invisible fingerprints that trap the writers of anonymous notes.

Not long ago, Luke S. May proved a typewritten contract had been altered by showing that the "9" in $49,000 responded differently under the bombardment of filtered ultra-violet rays from the other figures in the number. In changing the "0" to "9," the crook had used a typewriter whose ribbon seemed identical in color. But the chemical composition of the inks differed and the rays revealed the discrepancy. Again, May traced a libelous letter, damaging the business of a large company, through ray-revealed chemical stains on the paper.

Probably the most dramatic feat of rays in connection with handwriting took place in a middle western laboratory, a few months ago. A document, believed to be a forgery, was under examination. To determine if there were any alterations in the printed body of the paper, the expert carried it to his "ray room." In this darkened chamber, he placed the paper under the lamp and switched on the invisible rays. Instantly, there appeared in a lower corner of the paper a glowing golden circle!

Under the action of "black light," different substances glow, or fluoresce, with distinctive colors. The whole document had been cleverly forged on a special printing press and the genuine seal removed from a real document and placed on the fraudulent paper by means of glue the exact shade of the seal. Only under the ultra-violet lamp was this deception noticed, the glue around the edges of the seal containing a chemical that burst into a vivid sheen when struck by the rays.

When writing is done with iron gall ink, the acid eating into the paper leaves a deposit of the metal in the fibers. Such a paper, even after the writing has been completely erased with chemicals, can be placed under ultra-violet light and the words brought out distinctly enough to photograph.

ANOTHER form of special photography, "pressure pictures," yields evidence against the criminal penmen in the laboratories of scientific sleuths. Light is directed over a document at an angle almost parallel to it, when the picture is taken. Erasure marks, and every indentation in the paper, stand out clearly under such lighting.

A picture of this sort, I learned, recently cleared up a Chicago blackmail case. The final warning to the intended victim was printed in pencil on paper from a cheap tablet. Detectives swooped down on the house of a suspect two hours after the note was received. Between the leaves of a large Bible, they discovered a tablet whose paper matched that of the anonymous letter. When the top sheet was photographed under a strong side light, the words of the blackmail note became visible, indented into the paper by the pressure of the pencil when the original was printed on the leaf above!

An even more astonishing case, in which "sidelight photography" figured, was solved in an eastern state. A business man, of dubious reputation, borrowed $500 and gave his personal note in return. The man who lent him the money saw him dip a pen into ink and sign his name on the note. A little later when he was putting the paper into his safe deposit box at the bank, his hand brushed across it and the signature disappeared as if by magic. He rushed back to the business man's office. He was gone, and the next day denied he had ever borrowed any money.

In his dilemma, the victim of the transaction sought help in the laboratory of a handwriting sleuth. This scientific detective photographed the note in a strong sidelight. The resulting picture showed the faint lines of the signature indented into the paper by the pen, but they were too indistinct to prove the case in court. Then, the victim recalled that, at the time the note was signed, he noticed the ink was of a striking, deep blue shade. The detective was all attention.

"This color?" he asked swiftly mixing a white powder in water and adding a few drops of iodine. The whitish fluid turned blue.

"That's it!"

"Then we've got him!"

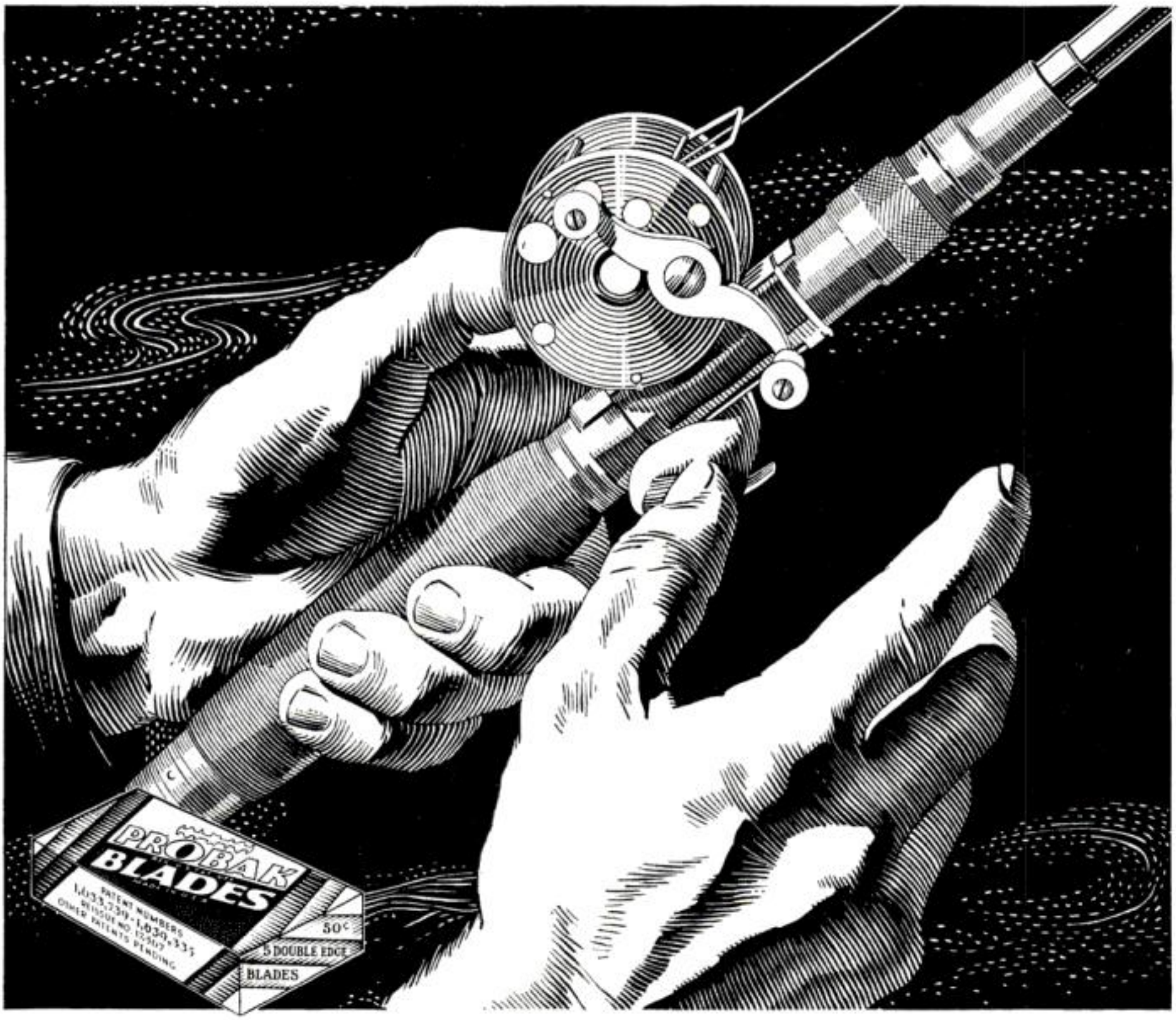
The detective explained that the "ink" was starch-water mixed with iodine. In chemical laboratories, iodine is used to detect the presence of starch. If a solution contains starch, it will take on a characteristic bluish hue when iodine is added. When an "ink" prepared from iodine and starch has dried, it rubs off like dust. But in drying, a little of the starch soaks into the paper.

The detective placed an evaporating dish filled with iodine over a burner, and held the paper in the purple vapor that resulted. When he took the note away, the reaction of the iodine and the starch brought out the signature clearly enough to photograph it.

Next Month

WATCH for the next installment of this fascinating series. It will give you thrilling facts about the work of medical sleuths. Learn how these scientific detectives unearth clues and track down murderers through knowledge of the human body. In May POPULAR SCIENCE MONTHLY, *out April 1.*

ARE YOU THIS KIND OF A MAN ?



● We're talking to you regular men, whether you're chained to a desk or work outdoors. You'd rather hear the splash of a bass than listen to the Moonlight Sonata. Your beard is tough and you find it hard to shave. The double-edge Probak blade is designed for bristles like yours. You can feel it on your face. This is why hundreds of thousands of he-men say "Probak is a far better blade." Join the army of "regular guys" who get real shaving comfort with Probak. Buy a package on our guarantee and match a blade or two against your beard. See how it mows down the stubble, cutting every hair cleanly at the base. Make the test tomorrow morning. If Probak doesn't measure up to your expectations – return the package with unused blades to your dealer and he'll refund the full price.

PROBAK BLADES

THE BLADE FOR MEN THAT *ARE* MEN

"Now I use LUCKIES only"

POOR LITTLE RICH GIRL

Sue Carol's wealth was a hindrance rather than a help. Hollywood thought she was ritzy, but Sue soon proved she was a "regular guy"... she made 14 pictures her very first year . . . her latest is UNIVERSAL'S "GRAFT." She has reached for a LUCKY for two years. Not a farthing was paid for those kind words. That's white of you, Sue Carol.

I have had to smoke various brands of cigarettes in pictures, but it was not until I smoked Luckies that I discovered the only cigarettes that did not irritate my throat. Now I use Luckies only. The added convenience of your improved Cellophane wrapper that opens so easily is grand."

Sue Carol

"It's toasted"

Your Throat Protection — against irritation — against cough

And Moisture-Proof Cellophane Keeps that "Toasted" Flavor Ever Fresh